ORIGINAL

E000008482

MEMORANDUM

TO: Docket Control

FROM: Elijah O. Abinah
Director
Utilities Division

DATE: August 20, 2020

RE: IN THE MATTER OF THE RATE REVIEW AND EXAMINATION OF THE BOOKS AND RECORDS OF ARIZONA PUBLIC SERVICE COMPANY AND ITS AFFILIATES, SUBSIDIARIES AND PINNACLE WEST CORPORATION. (DOCKET NO. E-01345A-19-0003)

Attached is the evaluation completed by Arizona Corporation Commission Utilities Division Staff's consultant, Energytools, LLC, regarding the Arizona Public Service Company Rate Comparison Tool.

EOA:RSP:elr/

Originator: Ranelle Paladino

Attachment

ACC - Docket Control - Received 8/20/2020 8:00 AM
ACC - Docket Control - Docketed 8/20/2020 8:06 AM

On this 20th day of August, 2020, the foregoing document was filed with Docket Control as a Utilities Division Memorandum, and copies of the foregoing were mailed on behalf of the Utilities Division to the following who have not consented to email service. On this date or as soon as possible thereafter, the Commission's eDocket program will automatically email a link to the foregoing to the following who have consented to email service.

Stacey Champion
3101 North Central Avenue, Suite 174
Phoenix, Arizona 85012
sc@champion-pr.com
Consented to Service by Email

Thomas Loquvam
Pinnacle West Capital Corporation
400 North 5th Street, MS 8695
Phoenix, Arizona 85004
thomas.loquvam@pinnaclewest.com
Melissa.Krueger@pinnaclewest.com
Kerri.Carnes@aps.com
Debra.Orr@aps.com
Thomas.Mumaw@pinnaclewest.com
Theresa.Dwyer@pinnaclewest.com
Consented to Service by Email

Robin Mitchell
Director/Chief Counsel, Legal Division
Arizona Corporation Commission
1200 West Washington Street
Phoenix, Arizona 85007
legaldiv@azcc.gov
utildivservicebyemail@azcc.gov
Consented to Service by Email

By:
Edna Luna-Reza
Administrative Support Specialist

ATTACHMENT

energytools, llc.

11910 Parklawn Drive, Suite P, Rockville, MD 20852
Ph: 240.221.0880 • Fax: 240.465.3000
et@energytoolsllc.com

www.energytoolsllc.com

August 19, 2020

Mr. Elijah O. Abinah
Utilities Division Director
Arizona Corporation Commission
1200 West Washington Street
Phoenix, Arizona 85007

Dear Mr. Abinah:

Transmitted with this letter is our report entitled "Analysis of the APS Rate Comparison Tools" in satisfaction of your requirements as outlined in Utilities Contract No. 372. This report contains the results of a five-month investigative effort by Energytools that involved formal discovery requests, interviews with APS personnel, and extensive analysis of both the Initial Rate Comparison Tool and the New Rate Comparison Tool launched on January 29, 2020.

The report contains seven critical findings related to the analysis of the Initial Rate Comparison Tool. In general, we found deficiencies in the Company's logging of customer's interactions with the Tool, and a lack of testing of the Tool when APS updated its meter data management system in early February 2019. The logging deficiency precluded us from determining precisely how the Initial Tool performed. The testing deficiency allowed an error to enter the most economic rate plan recommendations of the Tool. Our report quantifies the number of customers affected by this error and the magnitude of the harm caused by the faulty most economic rate plan recommendations.

The report also documents five findings relative to our evaluation of the New Rate Comparison Tool and a previous analysis of that Tool by The Brattle Group. In general, we are confident in the ability of the New Tool to provide correct most economic rate plan recommendations to APS customers.

We have enjoyed working with you throughout the course of this engagement and look forward to discussing our report with the Commission at its convenience.

Sincerely,

Paul H. Raab
Partner
Energytools, LLC

Analysis of the APS Rate Comparison Tools

August 19, 2020

energytools, llc.

Table of Contents

I. INTRODUCTION AND EXECUTIVE SUMMARY

1. BACKGROUND

During the December 11, 2019 Open Meeting, the Arizona Corporation Commission ("Commission") directed the Utilities Division ("Staff") of the Commission to define the scope of an RFP for an independent investigation of Arizona Public Service Company's ("APS" or "Company") development, implementation and post-completion assessment of an online Rate Comparison Tool developed by the Company as part of the customer educational effort related to the new rate structure resulting from Docket Nos. E-01345A-16-0036 and E-01345A-16-0123.

The "Tool" referenced by the Commission in this case refers to two rate comparison tools offered by the Company in the wake of its Residential Rate Redesign in those dockets. The "Initial Tool," also referred to as the "GridX Tool" in this report, was launched for public use in August of 2018. Early in 2019, questions began to surface regarding the accuracy of the Initial Tool's results, and whether the Initial Tool's conclusions regarding the optimal rate plan for the customer were correct. Numerous ratepayers expressed concerns to APS and to the Commission regarding the level of reliance that could be placed on the Initial Tool's results. Because of these accuracy concerns, and because the Commission requested pro-forma bill comparisons, APS replaced its Initial Tool with a "New Tool" in February 2020.

In addition to investigating the recently discovered shortcomings surrounding the roll-out of the Company's Initial Tool, the Commission seeks an independent determination of the accuracy of the results derived from New Tool being developed by APS.

Among the topics discussed at the December 11, 2019 Open Meeting that were deemed relevant to this independent investigation by Commissioners were:

- Verification of APS's reported facts and circumstances surrounding the roll-out of the Initial Tool and timing of the identified problems.
- A thorough review and assessment of analysis and evaluation of the New Tool that was done by the Brattle Group ("Brattle"), an APS consultant, and its impacts on ratepayers.
- An independent determination of the number of ratepayers who were not directed to the most beneficial rate plan because of their reliance on the Initial Tool.
- An independent calculation of amounts individual ratepayers would have paid had they been directed to the most beneficial rate plan, versus what they actually paid due to the Initial Tool's misdirection.

- An independent review of APS's development and testing of the Initial Tool to determine if APS should have reasonably identified flaws in the Initial Tool or in its testing of the Initial Tool prior to roll-out.

This Report documents the requested investigation of these topics that was conducted by Energytools, llc, an information technology and consulting firm with a primary focus on the energy utility industry.

To conduct this review, Energytools relied on three primary sources of information. First, all documents in all dockets related to the Commission's request were reviewed and evaluated to determine if they raised issues relevant to the investigation of the Commission's topics of interest. Next, Energytools issued three rounds of formal discovery requests as well as informal follow-up data requests, consisting of more than 200 individual requests for data or information of the Company through Staff. Finally, interviews were conducted with Company personnel over three days during this investigation. These interviews were conducted as both follow up inquiries to written data requests and as vehicles to confirm Energytools' findings throughout the investigation.

A summary of each docket reviewed, the relevance (or irrelevance) of the issues raised in those dockets to this investigation of the Initial Tool or the New Tool, and how the issues raised in those dockets impact the evaluation of these tools are the subjects of the next section of this chapter.

2. A REVIEW OF DOCKETS RELATED TO THIS INVESTIGATION

The following dockets have been reviewed during this investigation:

- Docket No. E-01345A-16-0036 - In the Matter of the Application of Arizona Public Service Company for a Hearing to Determine the Fair Value of the Utility Property of the Company for Ratemaking Purposes, to Fix a Just and Reasonable Rate of Return Thereon, to Approve Rate Schedules Designed to Develop Such Return. This docket was subsequently consolidated with Docket No. E-01345A-16-0123, "In the Matter of Fuel and Purchased Power Procurement Audits for Arizona Public Service Company" based on a Staff Motion to Consolidate, which was approved in a Procedural Order dated August 1, 2016. Collectively, these Dockets are referred to in this Report as the Residential Rate Redesign Dockets and were the primary reason for the development of the Initial Rate Comparison Tool.

- Docket No. E-01345A-19-0003 – In the Matter of the Rate Review and Examination of the Books and Records of Arizona Public Service Company and its Affiliates, Subsidiaries and Pinnacle West Capital Corporation. This docket is referred to in this Report as the Rate Review Docket. The purpose of this docket was to evaluate all elements of the Company's Customer Education and

Outreach Program ("CEOP"), of which the Initial Rate Comparison Tool and the New Tool were integral parts.

- Docket No. E-01345A-19-0236 – In the Matter of the Application of Arizona Public Service Company for a Hearing to Determine the Fair Value of the Utility Property of the Company for Ratemaking Purposes, to Fix a Just and Reasonable Rate of Return Thereon, to Approve Rate Schedules Designed to Develop Such Return. This docket is referred to in this Report as the New Rate Case Docket. This docket was an outcome of the Rate Review Docket and resulted from a charge that the Company was over-earning because customers were not on the Most Economic Rate Plan ("MEP").

In the course of this investigation, Energytools also reviewed the documents filed in Docket No. E-01345A-18-0002 – In the Matter of the Formal Complaint Against Arizona Public Service Company filed by Stacey Champion and other Public Service Company Customers, February 2, 2019. This formal complaint docket was brought by Stacey Champion, an APS Ratepayer, that the rates and charges approved by Decision No. 76295 in Docket No. E-01345A-16-0036 are not just and reasonable because the actual average bill impact experienced by residential customers under the rates approved by Decision No. 76295 is significantly greater than the 4.54 percent projection that was the basis for the Commission's approval of the Settlement Agreement. This and other issues raised in this docket were judged to be not relevant to this investigation and, in any event, these issues have already been fully investigated by the Commission. The results of the Commission's investigation are the subject of Decision No. 77292.

DOCKET NOS. E-01345A-16-0036 AND E-01345A-16-0123

These dockets describe the regulatory filings associated with Company's Residential Rate Redesign, the *raison d'être* for the Rate Comparison Tools. The documents in these dockets provide background on the rates introduced in 2017, and the fundamental reason for which the Company needed to develop the tool. This docket also contains the initial complaints about the rates and the Initial Tool and the timing of those complaints.

On January 29, 2016 APS filed a Notice of Intent to File a Rate Case Application and Request to Open Docket ("Notice of Intent"), which was docketed as Docket No. E-01345A-16-0036. In addition to seeking "the establishment of just and reasonable rates"[1,2] based on "adjusted Test Year sales and expenses for the Company's jurisdictional electric operations for the twelve months that ended on December 31, 2015 (Test Year),"[3] APS indicated in this Notice of Intent that it sought to achieve a number of other objectives with its filing. Premier among these objectives was Commission approval of a redesign of Residential Rates. As stated in the Notice of Intent, APS intended to include in its rate case filing, the following:

> **Residential Rate Redesign**. APS' s current residential rate design predominantly collects fixed and demand-related costs through a volumetric energy charge. As a result, APS's rates only incentivize technologies that merely reduce the volume of energy consumed, regardless of when that volume is consumed and without regard for overall intensity of use. In addition, when a customer only reduces energy use, APS must still incur nearly 100% of its fixed and demand-related costs to serve that customer. Any of these costs that remain uncollected through that customer's volumetric charge will be reallocated to other customers. In its rate application, APS will propose better aligning its costs with prices to (i) provide price information that incents cost-reducing distributed technologies; and (ii) begin addressing the cost shift between customers that occurs when costs and prices are not aligned. APS will also propose modifications to its time-of-use rates, reducing the number of blocks and their price differential in its inclining block residential rate, and restating its service schedules in "plain-English" to enhance clarity and transparency for customers.[4]

Finally, the Company indicated its intent to "file its rate case on June 1, 2016 with a proposed effective date for new rates of July 1, 2017."[5]

Subsequently, on June 1, 2016, the Company filed its rate application "In the Matter of the Application of Arizona Public Service Company for a Hearing to Determine the Fair Value of the Utility Property of the Company for Ratemaking Purposes, to Fix a Just and Reasonable Rate of Return Thereon, to Approve Rate Schedules Designed to Develop Such Return" ("Application"). The Application provided the promised support for the Company's Residential Rate Design changes, which the Application argued were necessary because the "[c]urrent residential rate design sends inaccurate price signals to new technologies, making it more difficult for those new technologies to be viable options for customers"[6] and because the

---

[1] "Arizona Public Service Company's Notice of Intent to File a Rate Case Application and Request to Open Docket" filed in Docket No. E-01345A-16-0036, January 29, 2016, page 1, lines 23-24.
[2] This docket was subsequently consolidated with Docket No. E-01345A-16-0036, "In the Matter of Fuel and Purchased Power Procurement Audits for Arizona Public Service Company" based on a Staff Motion to Consolidate, which was approved in a Procedural Order dated August 1, 2016.
[3] Ibid., page 1, lines 25-26.
[4] Ibid., page 2, line 23 – page 3, line 12.
[5] Ibid., page 10, lines 9-10.
[6] "In the Matter of the Application of Arizona Public Service Company for a Hearing to Determine the Fair Value of the Utility Property of the Company for Ratemaking Purposes, to Fix a Just and Reasonable Rate of Return Thereon, to Approve Rate Schedules Designed to Develop Such Return" filed in Docket No. E-01345A-16-0036, on June 1, 2016, page 10, lines 7-8.

"[c]urrent residential rate design also creates inequitable cost shifts between customers."[7] The primary ways that the Company proposed to address these deficiencies were to add, in a revenue-neutral manner, "a third billing element, called demand, to all residential customers except the very smallest"[8] and to make "the basic service charge more cost based."[9] Another key element of the Company's proposed Residential Rate Redesign was that it would not be a one-size-fits all approach. Rather, the Company proposed several new rates and billing options, tailored to different customer usage levels and solar ownership characteristics. The Company also proposed "to change aspects of its time-of-use rates to better reflect cost of service, and better integrate them into the three-part structure."[10]

The details of the Company's proposed Residential Rate Redesigns were provided in the Direct Testimony of Charles A. Miessner, Manager of Rates. In his testimony, Mr. Miessner describes the rates that were in effect at that time (prior to the effective date of the new rates authorized in Decision No. 76295):

> APS currently serves more than one million residential customers with a variety of rate schedules and options including:
>
> - Inclining block rate,
> - Two time-of-use (TOU) energy rates,
> - Two TOU demand rates,
> - Super peak TOU rate,
> - Two dynamic rate options, and
> - TOU rate for electric vehicles.[11]

The major changes to these rate offerings that were being proposed by APS in the filing included cancellation of the inclining block rate, revisions to the TOU rates and creation of a new TOU demand rate option. In addition, the Company proposed an "extra small" rate with a service charge that was increased over current average levels, no demand charge and no time-of-use pricing. The demand charges were developed based on integrated hourly demand billing determinants and were to be applied only to the on-peak hours, which were proposed in the Company's direct case to be 3 p.m. to 8 p.m. weekdays. Off-peak hours including the mornings, early afternoon, nighttime, weekends, and designated holidays, which were to be exempt from demand charges.

[7] Ibid., page 10, line 9.
[8] Ibid., page 10, lines 24-25.
[9] Ibid., page 11, lines 1-2.
[10] Ibid., page 11, lines 7-9.
[11] Direct Testimony of Charles A. Miessner, Docket No. E-01345A-16-0036, page 21, lines 17-24.

In addition to the use of integrated hourly demands to develop the demand components of the proposed rates, the Company also proposed two additional features that were intended to avoid rate shock for customers as they transitioned between the traditional, two-part rate options and the proposed three-part rates. First, the Company proposed a "demand limiter," which set a demand ceiling based on a 15% load factor that would guard against higher than anticipated bills caused by inadvertent high demand among customers who were unaccustomed to three-part rates. Second, the Company did not propose a movement to full, cost-based basic service charges. Accordingly, per kWh energy charges continued to collect costs other than those that strictly vary according to the use of electricity and not all the intraclass subsidies were eliminated.

The Company also recognized that these rate structures were sufficiently different from the then-current rate structures offered by the Company and this realization led it to propose two additional features: (1) an educational process and (2) a transition period. The Company witness who was responsible for presenting the details of these features of the Company's Residential Rate Redesign proposals was Ms. Stacy L. Derstine, Vice President of Customer Service and Chief Customer Officer for the Company. Ms. Derstine explained the Company's proposed education plan as follows:

> APS will be implementing an education plan regarding changes to the service plans and will work with customers to refine its messaging. This plan will include bill inserts, website content, emails, and direct mail. It is our objective to make the transition to new plans as seamless for our customers as possible. APS will develop communications that are simple and easy to understand and which not only describe the specifics of the new plans, but also allow customers to be aware of behavioral actions they can take and programs they can participate in to help manage their demand and energy usage. APS will also offer an online rate calculator to customers so they can explore the new plans.
>
> Importantly, APS will help customers identify which of the new rate plans is best for them based upon their past usage profile. APS will complete a plan comparison using each customer's historical usage profile and move each customer to the new rate plan that is best suited for them. It is significant to note that although APS will move each customer to the best plan, the customer can select a different option if they so choose.[12]

A transition period was necessary to allow customers the opportunity to familiarize themselves with the various rate options for which they might be eligible and to select their preferred rate option. In this regard, the Settlement Agreement and Decision No. 76295 approved two sets of residential rates, Transition Rates, and a new suite of residential rates ("New Rates"). The Transition Rates were the existing residential rates adjusted on a uniform basis to reflect the authorized revenue requirement and were

[12] Direct Testimony of Stacy L. Derstine, ACC Docket No. E-01345A-16-0036, page 13, lines 12-25.

utilized to provide a window of time for APS to inform customers about the newly approved rate plans prior to transitioning to the New Rates that began in February 2018. The Settlement Agreement provided that all residential customers, except for grandfathered rooftop solar customers, would transition to APS's New Rates by May 1, 2018. After May 1, 2018, new residential customers, were required to initially select a TOU or three-part rate plan unless the customer used less than 600 kWh per month. Customers who did not select a new rate plan by May 1, 2018, were put on the New Rate that was "most-like" their existing rate. The following table describes these "most like" transitions:

Exhibit I-1

Rate	Commonly Known As	Status	Effective Date	Notes	Migrate to
R-XS	Lite Choice	Active	8/19/2017		
R-Basic	Premier Choice	Active	8/19/2017		
R-BASIC L	Premier Choice Large	Frozen	8/19/2017	Frozen May 1, 2018 per decision 76295	
R-TOU-E	Saver Choice	Active	8/19/2017		
R-2	Saver Choice Plus	Active	8/19/2017		
R-3	Saver Choice Max	Active	8/19/2017		
R-TECH	Saver Choice Tech	Active	8/19/2017		
E-12	Legacy Standard	Active	12/1/1988		R-XS, R-Basic, R-Basic L
ET-2	Legacy** Time Advantage 7PM-Noon	Active	7/1/2006		R-TOU-E
ECT-2	Legacy** Combined Advantage 7PM-Noon	Active	7/1/2006		R-3
ET-1	Legacy** Time Advantage 9PM-9AM	Active	12/10/1981		R-TOU-E
ECT-1R	Legacy** Combined Advantage 9PM-9AM	Active	12/1/1988		R-3
E-12	Transitional* Standard	Cancelled	12/1/1988	Ended after 2018 rate migration per decision 76295	
ET-2	Transitional* Time Advantage 7PM-Noon	Cancelled	7/1/2006	Ended after 2018 rate migration per decision 76295	
ECT-2	Transitional* Combined Advantage 7PM-Noon	Cancelled	7/1/2006	Ended after 2018 rate migration per decision 76295	
ET-1	Transitional* Time Advantage 9PM-9AM	Cancelled	12/10/1981	Ended after 2018 rate migration per decision 76295	
ECT-1R	Transitional* Combined Advantage 9PM-9AM	Cancelled	12/1/1988	Ended after 2018 rate migration per decision 76295	
ET-EV	Electric Vehicle Charging Rate	Cancelled	8/19/2017	Ended 8/19/2017 per decision 76295	
ET-SP	Time Advantage Super Peak 7PM-Noon	Cancelled	8/19/2017	Ended 8/19/2017 per decision 76295	

*Transitional added to name 8/19/2017

**Legacy added to name 8/19/2017 to indicate new qualifications related to grandfathered solar customers.

The Company's Residential Rate Redesign was the subject of a Settlement Agreement that was ultimately approved by the Commission on August 18, 2017.[13] It is important to note that, of the forty-six parties to Docket Nos. E-01345A-16-0036 and E-01345A-16-0123, twenty-nine signed the Settlement Agreement. Of the seventeen parties that did not enter into the Settlement Agreement, twelve of those parties participated in the settlement hearing either by filing testimony or by filing a Brief. Furthermore, in its Decision, the Commission made the following statements with respect to the Settlement Agreement and the resulting rate redesign:

> After reviewing the Settlement Agreement in its entirety, as well as the arguments in support of and in opposition to its adoption, we believe the Settlement Agreement is in the public interest and should be adopted, as discussed herein. As the Settlement proponents point out, a broad range of parties representing vastly different interests were able to craft a comprehensive agreement through negotiation and compromise. The Settlement Agreement provides a number

[13] Commission Decision No. 76295.

> of benefits for customers, including: a base rate increase substantially less than originally requested by APS, increased rate options for residential customers, including TOU rates with additional non-peak hours and days, a stay-out provision that precludes APS from seeking another base rate increase prior to June 1, 2019, a pilot program to incent customers to adopt technologies to manage demand and reduce system peak, increased assistance for low-income customers, continuation of a buy-through program for industrial customers, and a collaborative resolution of issues related to DG customers and net metering. When viewed in its totality, the benefits of adopting the Settlement Agreement outweigh the arguments in opposition raised by several non-signatory parties. We will therefore adopt the Settlement Agreement, for the reasons set forth above.[14]

Thus, it is a reasonable conclusion that the Commission and most parties believed that the rates proposed by APS in that case were reasonable and in the public interest, either in an absolute sense or in consideration of the other benefits offered by the settlement.

Three issues relevant to the current investigation were addressed in Decision No. 76295. First, the Settlement Agreement and subsequent Commission approval defined the new rates that were a key feature of the Company's Residential Rate Redesign effort. Second, the Settlement Agreement and Order also addressed the issue of how customers would be transitioned from legacy rates to the new rates. And finally, the Commission Decision ordered the development and implementation of a CEOP to assist customers in choosing that rate option that they preferred.[15] A component of the CEOP was the Initial Rate Tool.

Rates from the Settlement Agreement went into effect on August 19, 2017. These rates resulted in the menu of proposed rate choices for Residential customers that is summarized in Exhibit I-1. As can be seen there, Residential customers could choose from among seven different rate options, subject to eligibility requirements. These options included traditional, two-part, non-time-differentiated rates for the lowest usage customers and time-differentiated rates with no demand charges and time-differentiated rates with demand charges for higher usage customers. The Company also proposed a pilot rate option (R-Tech), designed to encourage customers to employ multiple behind-the-meter technologies to reduce on-peak energy and demand usage.

At this point, all parties were presumably in agreement about the need for Residential Rate Reform (the cost basis), the proposals that APS had made to implement this reform (the rate alternatives) and how those proposals were going to be implemented (the transition and education plans).

---

[14] Ibid, Page 60, lines 8-21, footnotes omitted.

[15] "[W]e will require APS to file a draft Customer Education and Outreach Program ("CEOP") in Docket Control within 15 business days of a Commission Decision in this matter." Decision No. 76295, page 54, lines 15-16.

The Initial Tool was a key component of the APS CEOP, the education process that APS implemented to facilitate customer transitions to the new rates. The reasonableness of the CEOP was the subject of an evaluation of the effectiveness of the educational process that was conducted by Overland Consulting and filed in Docket No. E-01345A-19-0003 on June 4, 2019.

The Overland Report describes the Initial Tool, and its context in the customer education process as follows:

> APS created several tools to help customers in selecting new rate plans and to manage their power usage. These included:
>
> Rate Comparison Tool - The rate comparison tool is one of the most important components of the CEOP. Prior to the rate plan transition, it enabled a customer to compare the annual costs of their legacy rate plan to the new rate plans available. This tool directly served customers and was also employed by APS's customer service to help explain the various rate plans to customers. Based on customer complaint information, the tool appears to have been generally effective, albeit not without some limitations. The tool remains available to customers and has evolved since first introduced in 2016.[16]

Based on its review of the Tool, the Overland Report found that:

> As part of the CEOP, APS created several tools to help customers select new rate plans and to manage their electricity usage. The most important of these was a rate comparison tool launched on the APS website that enabled customers to compare projected annual costs under their existing legacy rate plans to those associated with new rate plans. The tool remains available to customers to help select rate plans. Customer dissatisfaction caused by higher bills and the new modernized rate plans may have been worse had the rate comparison tool not been available.[17]

This suggests that no issues related to the operation of the Initial Tool had surfaced as of the date of the Overland Report, which was filed in Docket No. E-01345A-19-0003 on June 4, 2019, almost one year after APS began offering the rate comparison tool to residential customers in August of 2018.[18]

The current investigation is a part of this same docket and, according to the Company, it became aware that the Initial Rate Comparison tool may have been generating incorrect information on November 14, 2019. APS learned of potential calculation errors within the tool through customer communications with

[16] "Rate Review and Customer Outreach Program Evaluation of Arizona Public Service Company," Docket No. E-01345A-19-0003, June 4, 2019, page 14.
[17] Ibid., page 28.
[18] APS Response to Staff Data Request No. 11, Question No. 3(d).

the Commission, and independently verified that the tool was not working as expected due to an "integration error:"

> The on-peak hours were inadvertently mapped one hour earlier than they should have been, affecting estimates for certain residential customers who were considering and selecting a time-of-use rate plan or a demand rate plan using the tool. Specifically, the integration mapped on-peak hours as 2:00pm to 7:00pm, rather than the actual on-peak hours of 3:00pm to 8:00pm.[19]

The issues raised in the referenced customer communications with the Commission include the following:

- Access issues. Customers reported that they were unable to access the Tool through aps.com.[20] APS has also separately reported instances in which customer use of the tool exceeded its bandwidth.[21]

- Use of data that is not consistent with past billing data.[22]

- Incorrect model calculations.[23]

As a result of this information, APS made the decision to remove the Initial Tool from its website on November 14, 2019, although the Company has stated that a New Rate Comparison Tool was already under development at that time because of Commission Decision No. 77270 in Docket No. E-01345A-19-0003.[24] That order required, among other things, that:

> It is in the public interest for APS to provide customers with pro forma billing information on how much they would owe, given their actual usage during each month, if the customer was on his/her most economical plan. In addition to providing pro forma billing for each period on an ongoing basis, the Company shall also provide the pro forma billing for each customer who is not currently on their most economical plan for each billing period during the last 12 months. The Company shall continue to provide this billing information until the conclusion of the Company's next rate case or upon further order of the Commission.[25]

Because of the pro forma billing requirement, the Company decided to develop a new tool. As originally designed, the Initial Tool could not perform pro forma billing because it used interval data, not billing data, for its bill estimation. To allow for an on-the-bill identification of the customer's lowest cost plan, it was necessary to integrate the development of the rate comparison calculations with the billing system, and

---

[19] Ibid.
[20] Consumer Comments/Letters – Miscellaneous, filed in Docket No. E-01345A-19-0003 by Steve Neil on June 6, 2019.
[21] APS response to Letter from Commissioner Sandra Kennedy filed December 19, 2019 in Docket No. E-01345A-19-0003, page 2.
[22] Consumer Comments/Letters – Miscellaneous, filed in Docket No. E-01345A-19-0003 by Abhay Padgaonkar on November 14, 2019.
[23] Ibid.
[24] APS Response to Staff Data Request No. 11, Question No. 4(a).
[25] Commission Decision No. 77270 in Docket No. E-01345A-19-0003, ¶40.

to complete the calculations in a short timeframe to include the current month's billing information in the on-bill calculations.[26]

Considering these events, the Commission wanted: (1) an independent review, investigation and analysis of the development and implementation of the Initial Tool, including an independent determination of the number of ratepayers and the resulting financial impact to these customers who, when relying on the results generated from the Initial Tool, were not directed to the most beneficial rate; and (2) an independent assessment of the analysis of the New Tool. As a result, the Utilities Division of the Arizona Corporation Commission Staff released a Request for Proposals ("RFP") to address these issues. The specific requirements of that RFP are discussed in greater detail in the following section of this chapter.

DOCKET NO. E-01345A-19-0236

Order No. 77270 in Docket No. E-01345A-19-0003 also required the filing of a rate case to address any issues related to the issue of whether APS was over-earning because of the introduction of its rate design. While Energytools has reviewed the information contained in this docket, there do not appear to be any issues directly relevant to our investigation of the accuracy and efficacy of the Initial or New Tools raised in this docket.

3. THE RFP AND THE CURRENT EFFORT

This section of the report summarizes the overall work requirements from the RFP, the major work elements that were undertaken to satisfy these work requirements, the areas for investigation in which Staff is most interested, and related findings. It is structured to provide an outline for the four remaining chapters in this report. In addition, this section concludes with a compilation of all conclusions drawn and recommendations made as a result of this investigation.

Chapter II: Evaluation of the Initial Tool

Staff Request/Scope of Work. Independent review, investigation and analysis of the development and implementation of the Initial Tool.

[26] APS Response to Staff Data Request No. 11, Question No. 4(a).

Major Work Elements:

1) Researching the timeline surrounding the development, implementation and testing of the Rate Comparison Tool, going back to August 19, 2017, the effective date of the new rates authorized in Decision No. 76295.

2) While giving consideration to filed public comments, Commissioner questions, and the applicable APS responses to such inquiries and the subsequently discovered Initial Tool shortcomings; assess the reasonableness of the APS's Rate Comparison Tool development plan:

   a) Including an assessment of the steps taken to identify the factors, such as changes in customer usage and other relevant consumption data affecting customer billings such as time-of-day usage considerations, that were critical to the accuracy of the output from the Rate Comparison Tool.

   b) The reasonableness of the type and level of testing completed before the Rate Comparison Tool was available to the public.

3) Verification of APS's reported facts and of the circumstances surrounding the roll-out of the initial Rate Comparison Tool and the timing, nature and identification of problems with the results from the Rate Comparison Tool.

Anticipated Results:

- Verification of APS's reported facts and circumstances surrounding the roll-out of the initial Tool and timing of the identified problems.

- An independent review of APS' development and testing of the initial Tool to determine if APS should have reasonably identified flaws in the Tool or in its testing of the Tool prior to roll-out.

Findings Related to the Initial Tool:

Finding II-1. The testing that APS performed to ensure that the model was functioning properly when it was launched in August 2018 was adequate, and Energytools could find no evidence to suggest that the Initial Tool was not providing accurate rate comparison information at that time.

Finding II-2. On February 4, 2019, an error was introduced into the Initial Tool when APS updated its meter data management system and integrated that system with the GridX Model. This error compromised the ability of the Initial Tool to provide accurate MEP recommendations. Had APS performed the same level of testing on the Initial Tool at that time as was employed when it was initially introduced, this error would have been identified. APS bears full responsibility for not identifying this error at that time.

Finding II-3. APS.COM did not log the initial rate recommendation website, or the data that it served, which was based on information from GridX and contained pages that were populated and served by

GridX. This has resulted in the shortcoming of not being able to fully determine the flow of customers to the tool, determine and tally their user experience, and evaluate the exact information that they were presented before making a rate change decision.

Finding II-4. There was an acknowledged mismatch between the TOU periods of the TOU rates and the TOU periods that were used to develop billing determinants for the GridX model. This mismatch was significant enough to cause the GridX model to make incorrect recommendations related to the "best" rate plan for customers who accessed the model. Based on the methodology discussed in Chapter IV, the potential impact to customers because of this error is $479,338.

Finding II-5. Based on APS representations and Energytools' independent analysis, there is no evidence that the GridX model itself was performing incorrectly or generating incorrect information. Rather, any identified errors were the result of improper inputs being provided to the model through an improper mapping of the TOU billing determinants. The impact of these errors is quantified in Chapter IV.

Finding II-6. Energytools has been unable to uncover any evidence that the Initial Tool was using information that was not consistent with historical data, except for the integration issues discussed above. Energytools has also been unable to uncover any evidence that the Initial Tool was generating bill comparisons whose differences from historical bills cannot be explained by differences in data inputs used to perform that function.

Finding II-7. Energytools agrees with the Company that a lack of accurate data prevented non-AMI and solar customers from using the Initial Tool. However, this is not a shortcoming of the Initial Tool, but rather a lack of reliable data that would allow users to exercise the Tool properly.

Chapter III: Evaluation of the New Tool

Staff Request/Scope of Work: an independent assessment of the analysis of the tool performed by the Brattle Group, an APS consultant.

Major Work Elements:

5) Perform a thorough and independent review and assessment of an analysis and report by the Brattle Group, APS's consultant, regarding Brattle's evaluation and testing of the Tool and its impacts on ratepayers.

7) Review, analyze, test, and evaluate the revised Rate Tool to ensure the accuracy of its results.[27]

8) Develop recommendations regarding how to assist ratepayers in order to ensure that they understand how to use the revised Tool. Such recommendations should include an evaluation of how possible changes to the current rate plan names (i.e. Savers Choice, Savers Plus, etc.) might reduce confusion, and contribute to enhancing consumer understanding of, and decision making regarding available rate plan choices. Identify any disclaimers that should be given to users of the revised Tool in order to assure that Tool users understand the limits to which such a tool can provide accurate forecasts of future customer bills, given that changes in customer behavior cannot be factored into the Rate Comparison Tool analysis.

Anticipated Result. A thorough review and assessment of analysis and evaluation of the Tool that was done by the Brattle Group, APS's consultant, and its impacts on ratepayers.

Findings Related to the New Tool:

Finding III-1. Energytools agrees with the methodology employed by Brattle to validate the accuracy of the New Tool. It relies on the same steps that Energytools itself relies on to independently validate the accuracy of the New Tool. Furthermore, Energytools agrees with the Brattle Report statement that the sample of accounts that it relied on to validate the accuracy of the New Tool are representative of a range of billing characteristics similar to those of a broader population of residential customers.

Finding III-2. Although the Energytools evaluation of the Brattle analysis did not require a specific identification of the customers in each of the above groups, Energytools agrees with Brattle's treatment of these customers in its analysis.

Finding III-3. Energytools has found no errors in the Brattle analysis results based on its own independent evaluation of the Brattle dataset. Based on this analysis, Energytools agrees with the conclusions that Brattle has reached in its analysis of the New Tool.

Finding III-4. Energytools has been able to confirm the accuracy of the New Tool recommendations with 99.98% accuracy.

Finding III-5. The revised data handling and analysis processes employed by the New Tool resolve the meter data transfer issues that were present in the Initial Tool and also resolve the consistency problems between calculated billing determinants and bills and historical billing determinants and bills.

---

[27] The numbering scheme for these tasks is not sequential, but rather follows the numbering scheme in the RFP for reference.

Chapter IV: Impact of the Identified Tool Errors

Staff Request/Scope of Work: independent review, investigation and analysis of the ratepayer impacts that resulted from the flawed roll-out of the Initial Tool.

Major Work Elements:

4) Completing an independent review of the information posted on the APS website to verify the accuracy of the reported information.

6) Complete an independent determination of the number of ratepayers who, when relying on the results generated from the Initial Tool, were not directed to the most beneficial rate plan; and calculate an estimate of the financial impact to these customers from this misdirection.

Anticipated Results:

- An independent determination of the number of ratepayers who were not directed to the most beneficial rate plan.
- An independent calculation of amounts individual ratepayers would have paid had they been directed to the most beneficial rate plan, versus what they actually paid due to the Tool's misdirection.

Finding IV-1. Energytools estimates that 2,889 customers were potentially affected by incorrect MEP recommendations by the Initial Tool from February 2019 through November 2019. The estimated bill impact for these customers over the period during which the Initial Tool was providing incorrect rate recommendations is $99,510. If one were to expand the time period over which bill impacts are assumed to accrue through February 2020, the first full month after the New Tool was available to customers, the Energytools estimate of bill impacts to customers is $221,762.

Finding IV-2. Using a more expansive definition of what constitutes a negative bill impact for customers, the Company has estimated that 5,274 customers were potentially affected by incorrect MEP recommendations by the Initial Tool from February 2019 through November 2019, with an estimated total bill impact of $223,194.

Finding IV-3. For the months beyond November 2019, the Company refunded $310,057 to customers. Energytools estimates that the additional bill impact is $221,762 - $99,510 = $122,252. A portion of this difference is due to the fact that the Company has quantified bill impacts over a longer time period than used by Energytools in its analysis (through April 2020).

Finding IV-4. Using the subset of customers in their APS.COM and call center logs for customers who did not change their rate class, the Company has estimated that 3,001 customers were potentially

affected by incorrect MEP recommendations by the Initial Tool from February 2019 through November 2019, and provided refunds of $148,738 accordingly, followed by $58,907 refunded for the period up through April 2020.

Finding IV-5. As an upper bound, Energytools estimates that 4,098 customers who stayed on an incorrectly recommended rate class were potentially affected by incorrect MEP recommendations by the Initial Tool. The estimated bill impact for these customers over the period from February 2019 through November 2019 during which the Initial Tool was providing incorrect rate recommendations is $230,290. If one were to expand the time period over which bill impacts are assumed to accrue through February 2020, the first full month after the New Tool was available to customers, the Energytools estimate of bill impacts to customers is $339,229. However, the bill estimate precision for this group of customers is less than the corresponding precision for those customers who changed to a different rate class. Therefore, we believe that the lower bound estimate, based on excluding bill impacts that are less than $10 or less than 3% different from their MEP, is probably a better estimate.

4. CONCLUSIONS AND RECOMMENDATIONS

This report documents the Energytools review of the development, implementation and post-completion assessment of an online Rate Comparison Tool developed by the Company as part of the customer educational effort related to the new rate structure resulting from Docket Nos. E-01345A-16-0036 and E-01345A-16-0123. There are three components of this review: (1) a review of the Initial Rate Comparison Tool; (2) a review of the New Rate Comparison tool developed to address acknowledged errors in the Initial Tool; and (3) an estimate of impacts to ratepayers as a result of reliance on these tools.

With respect to our review of the Initial Tool, we believe that the calculation engine for this tool, the GridX model, performed correctly and would have provided reliable MEP rate recommendations had it been provided with accurate billing determinants. We further believe that any misinformation provided to model users was the result of errors in the other processes, specifically the integration of the data warehouse and the GridX model itself, and we believe that APS bears full responsibility for not testing the integration more fully when it was implemented and ultimately for any bad MEP recommendations that resulted from this error. However, because of a lack of web log information, it is impossible now to unequivocally confirm these findings, primarily because there is no record of the results that the Initial Tool produced, nor of the recommendations it made. Energytools recommends that, in the future, APS should implement full web logging related to information pages that are/can be used for the customer to make rate class change decisions.

With respect to the New Rate Comparison Tool, after performing a detailed analysis of the report by the Brattle Group regarding Brattle's evaluation and testing of the Tool, Energytools agrees with the methodology employed by Brattle to validate the accuracy of the New Tool and further agrees with the conclusions that Brattle has reached in its analysis of the New Tool. Energytools has also confirmed the accuracy of the MEP recommendations of the New Tool through an independent analysis. Furthermore, Energytools believes that the revised data handling and analysis processes employed by the New Tool resolve the meter data transfer issues that were present in the Initial Tool and also resolve the consistency problems between calculated billing determinants and bills and historical billing determinants and bills.

Energytools has also developed recommendations regarding tool usage, rate plan names, and potential disclaimers that emphasize for ratepayers the strengths and limitations of the Tool recommendations. It is important to recognize that these recommendations are based on Energytools's general ratemaking knowledge and experience from a national perspective and are not intended to supersede any recommendations that the Company develops in conjunction with its customer working group and the efforts of that group are probably more useful for the Company and its ratepayers than the Energytools recommendations provided in this section of the report. However, we offer them as potential considerations based on our general familiarity with rate issues throughout the country.

Finally, Energytools has calculated the ratepayer impacts from potentially inaccurate MEP recommendations made by the Initial Tool over the period of February 2019 through November 2019 for two groups of customers: those customers who made a suboptimal rate class change based on an incorrect MEP recommendation by the Initial Tool, and those customers who remained on a suboptimal rate class based on an incorrect MEP recommendation by the Initial Tool. Recognizing that there is imprecision in this estimate because it is not known precisely what recommendations were made by the Initial Tool or whether customers would have chosen the MEP given correct information, it would appear that the Company has adequately compensated customers who changed rate classes for any potential bill impacts associated with the Initial Tool error.

With respect to those customers who remained on a suboptimal rate class based on an incorrect MEP recommendation by the Initial Tool, we believe that there may be as many as 1,100 more customers than estimated by the Company who were provided incorrect information from the Initial Tool and, as a result, stayed on a suboptimal rate, although the Energytools estimate is an acknowledged "upper bound" on customers who may have been affected. Furthermore, our estimate of rate impacts including these customers could potentially be higher in total than the Company has estimated although this is again an upper bound.

II. EVALUATION OF THE INITIAL TOOL

1. INTRODUCTION

This chapter presents the results of a detailed independent review, investigation and analysis of the development and implementation of the Initial Tool that the Company developed and made available to customers in August 2018 after Commission approval of the Residential Rate Redesign in Order No. 76295 on August 19, 2017.

Development and implementation of the Initial Tool began in June 2017 and resulted in its launch on August 12, 2018. Before that, APS had a rate tool that was only able to compare two selected rate classes. The GridX tool was developed to provide service plan education for customers, add functionality (the ability to compare the cost of all eligible residential service plans based on the customer's historical usage), and reduce the system processing constraints and limitations of APS's previous rate comparison tool. Thus, the rate comparison tool allowed customers to make an informed decision about which service plan was the most economical (the customer's Most Economic Plan or "MEP") so that customers could decide which plan best met their needs and the Company could provide customer-specific messaging and energy-saving tips.[28]

The influence of the Initial Tool on the selection of a customer's MEP was pervasive, as it was used not only by external users but also by Company users. Initially, the tool was used to determine the MEP recommendation in letters that were sent to customers following the voluntary transition period that ended on May 1, 2018. Subsequently, customers could access the tool through aps.com to determine for themselves the bill impact resulting from choosing service under alternative rates. And finally, if a customer called the Company to inquire about alternative rate plans, the APS Customer Service Representative ("CSR") accessed the tool to assist customers in determining the bill impact resulting from choosing service under alternative rates.

As described more fully in the sections below, evaluation of the Initial Tool was accomplished through an extensive discovery process. Specifically, the following discovery was conducted and forms the factual

[28] APS Response to Staff Data Request No. 11(a).

basis for the Energytools review, investigation and analysis of the development and implementation of the Initial Tool:

- Review of all filings in the following Dockets: E-01345A-16-0036, E-01345A-16-0123, E-01345A-18-0002, E-01345A-19-0003, and E-01345A-16-0236.

- Issue Data Requests to the Company. Over the course of this evaluation, Energytools issued three rounds of written discovery requests to the Company. An initial Data Request (Staff Data Request No. 11) was issued to APS on April 7, 2020 and information was received on April 22, 2020. After review and processing of the data provided in response to Staff Data Request No. 11, a Follow-up Data Request was issued on May 11, 2020 (Staff Data Request No. 12). Clarification of certain information requested in Staff Data Request No. 12 was the subject of a conference call involving APS, Staff and Energytools on May 19, 2020. Responses to Staff Data Request No. 12 were received on May 26, 2020 and a supplemental response was received on June 17, 2020. Staff Data Request No. 13, the primary focus of which was the "New" Tool developed by APS to correct issues identified in the Initial Tool, was issued on May 12, 2020 and responses were received from APS on May 26, 2020 and June 10, 2020.

- Interviews with APS personnel. Over the period of July 22 to July 24, Energytools conducted a series of interviews with APS personnel to obtain further clarity on issues with the Initial and revised rate analysis tools.

The information and analysis described in this chapter addresses the following major work elements requested by the Commission in its Request for Proposals ("RFP") issued on January 16, 2020:

1. Researching the timeline surrounding the development, implementation and testing of the Rate Comparison Tool, going back to August 19, 2017, the effective date of the new rates authorized in Decision No. 76295.
2. While considering filed public comments, Commissioner questions, and the applicable APS responses to such inquiries and the subsequently discovered Initial Tool shortcomings; assess the reasonableness of the APS's Rate Comparison Tool development plan:
    a) Including an assessment of the steps taken to identify the factors, such as changes in customer usage and other relevant consumption data affecting customer billings such as time-of-day usage considerations, that were critical to the accuracy of the output from the Rate Comparison Tool.
    b) The reasonableness of the type and level of testing completed before the Rate Comparison Tool was available to the public.
3. Verification of APS's reported facts and of the circumstances surrounding the roll-out of the Initial Rate Comparison Tool and the timing, nature, and identification of problems with the results from the Rate Comparison Tool.

The Energytools analysis within each of these major work elements is presented in the following five sections of this chapter. The first section discusses the structure of the Initial Tool. What has been referred to as the Initial Tool in this docket and elsewhere is actually composed of four distinct model components: (1) a Meter Data Management ("MDM") system; (2) a data warehouse that compiles and stores information from the MDM; (3) a data integration process that transfers data from the data warehouse to an alternative rate calculation engine; and (4) the alternative rate calculation engine (the "GridX Model"). Because the correct operation and integration of these individual components are integral to the development of a correct rate recommendation by the Tool, it is important that the operation and integration of the individual components be understood. This is done in the section immediately following this one. The section following that one presents the timeline surrounding the Company's development, implementation and testing of the initial rate comparison tool. The next section provides a detailed evaluation of the Initial Tool components identified above. It also includes an evaluation of issues associated with model availability issues through the Company's website, aps.com, because even had the Initial Tool been operating correctly, it would have provided no benefit to customers if they were unable to access it. Next, a section discusses other issues associated with the Initial Tool that were raised by customers and Commissioners in this docket during review of the Initial Tool. Finally, this chapter concludes with a section that summarizes the findings, conclusions, and recommendations associated with the Energytools review of the above areas.

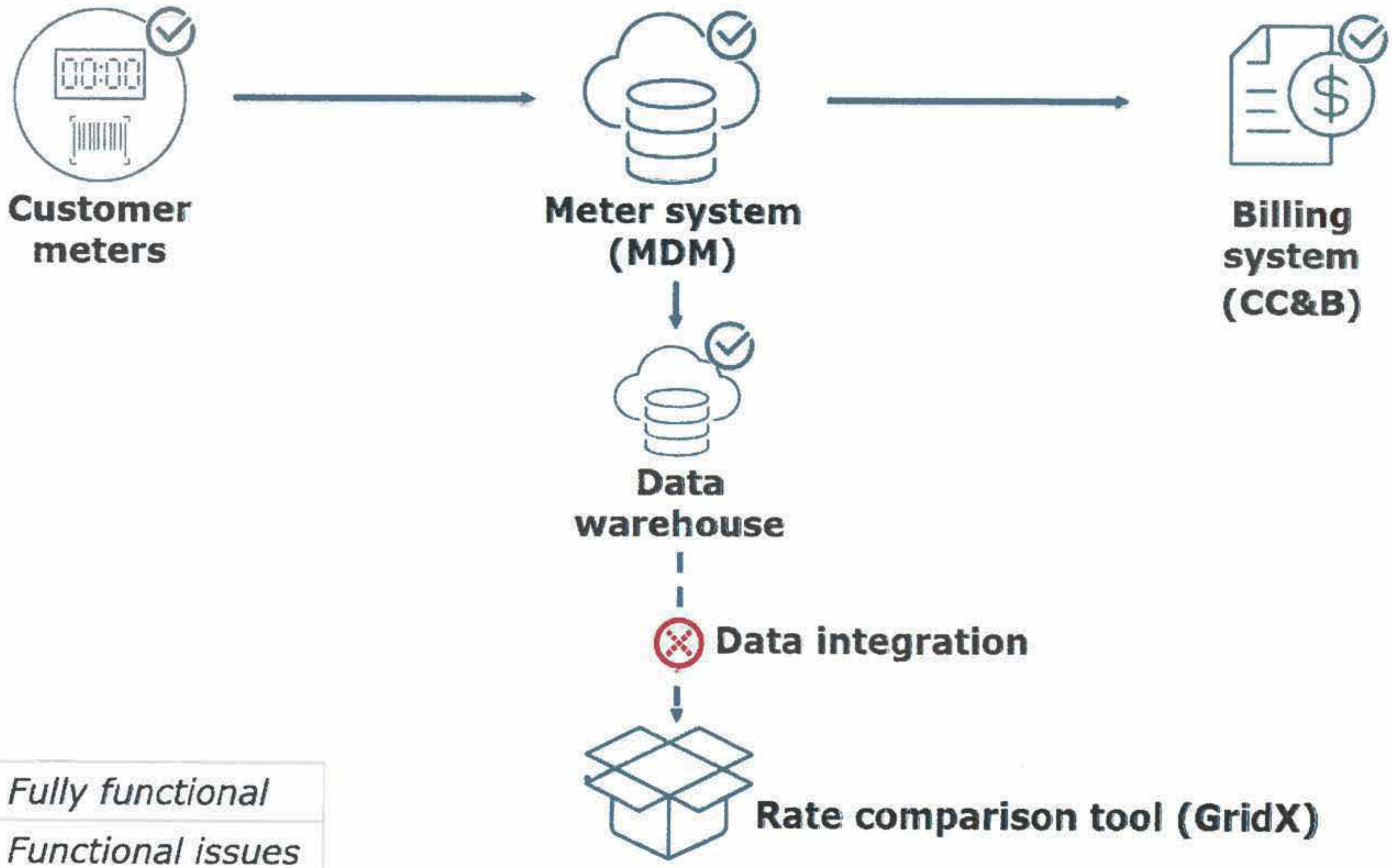
2. STRUCTURE OF THE INITIAL TOOL

The structure of the Initial Tool is provided graphically in Exhibit II-1[29]. In addition to the customer meters and the APS CC&B system, this graphic shows the four distinct model components of the Initial Tool. The Meter Data Management system compiles data from individual customer meters for transfer to the CC&B or the data warehouse. The specific data compiled and transferred includes kWh consumption by TOU interval and peak demand (kW) data, however, it is important to understand that the data transferred to the CC&B and to the data warehouse are not necessarily in the same form. The data transferred to the CC&B are largely "register" data, or data developed and held in individual data registers in the customer meters. An example of register data is the customer's peak demand, which is calculated by comparing the peak data for the current period to the maximum peak demand over all previous periods, which is a single value stored in a meter register. If the current period peak demand is greater than the value

[29] This graphic was prepared by APS for interviews with Energytools that were conducted on July 22, 2020.

Rate Comparison Tool – Issue Summary

WHAT HAPPENED



✓	*Fully functional*
⊗	*Functional issues*

currently stored in the peak demand register, it replaces the current value in the register. If it is not greater than the value currently stored in the peak demand register, no replacement takes place and the current period peak demand can be forgotten for billing purposes. The important point here is that relatively little data must be stored and transferred to the CC&B to generate an accurate bill. Register data, such as that used in the CC&B, can be contrasted to hourly "interval" data such as is stored in the data warehouse and used in the rate comparison tool engine. Interval data is calculated over different time intervals and can be used to develop all of the different billing determinants needed to compare two completely disparate rate structures. For example, interval data in hourly detail allows for a comparison of two rates that rely on completely different TOU periods. In this case, the Company recorded interval data for each hour of the day. Recording interval data at this detailed level provided the Company with the maximum rate comparison flexibility. The price for this level of flexibility is that data in this form are voluminous and because data transmission between the meters and the MDM is not perfect, data over specific intervals can be lost. Specifically, APS has indicated that about 1% of the meters have missing interval data.[30] Nonetheless, as indicated in Exhibit II-1, the Company reports that the customer meters, the MDM and the CC&B were all working properly, both individually and in conjunction with one another, so that the data being stored in the data warehouse were accurate during the entire period of time over which the Initial Tool was being used.

The next important model component of the Initial Tool was the data integration software that transferred the hourly interval data from the data warehouse to GridX for the rate comparison tool on a daily basis. As will be discussed in greater detail below, an error in this model component, introduced when the MDM was updated in February 2019, resulted in the rate comparison tool being provided incorrect billing determinants. As a result, the alternative rate calculation engine did not always generate accurate bills upon which the MEP recommendations of the Initial Tool were based.

3. TIMELINE SURROUNDING THE DEVELOPMENT, IMPLEMENTATION, AND TESTING OF THE RATE COMPARISON TOOL

The Initial Tool went through two phases of development, implementation and testing that correspond to the two different intended uses of the model. The first phase took place during September 2017 to February 2018 and was intended to prepare the model for use as an internal Company tool for use by

[30] Energytools was able to confirm this value, based on information provided by the Company.

Company CSRs and to develop rate recommendations in the initial customer education letters implemented when new residential rates were approved in Decision No. 76295 and after the transition to customers' most like plans that ended on May 1, 2018.[31]

During the second development and implementation phase, the online rate comparison tool was made available to all customers through aps.com. These calculations were later verified in June through August 2018 when all model components were integrated with the online GridX rate comparison tool.

Model testing was essentially the same for both phases:

1. The Company tested that the integrated system was accurately transferring data from the MDM to the GridX Model. This test was performed by comparing a sample of billing determinants that the MDM was transferring to the GridX model to the same billing determinants that were manually extracted from the MDM.
2. The Company tested that the GridX model was accurately calculating bills under the alternative eligible rate options for each customer. This was tested by comparing the customer bills calculated by GridX to bills calculated independently by Company personnel.
3. The Company tested that the MEP rate recommendation for each customer was consistent with the alternative bills generated in step 2.[32] This was tested by comparing the MEP rate recommendation calculated by GridX to the MEP rate recommendation calculated independently by Company personnel.

In response to Staff Data Request No. 11, Question No. 3(m), the Company provided 129 Excel spreadsheets that document the testing performed and the results of that testing. Of the 129 spreadsheets, 103 are related to testing for phase 1 and 26 are related to testing for phase 2. During this review, Energytools reviewed these spreadsheets and they confirm the following: (1) APS thoroughly tested that the integrated system was accurately transferring data from the MDM to the GridX Model; (2) APS confirmed that the GridX model was accurately calculating bills under the alternative eligible rate options for each customer; and (3) APS confirmed that the MEP rate recommendation for each customer was consistent with the alternative bills generated.

For example, spreadsheet APSAR00645, prepared on September 24, 2017, compared the annual bills calculated by the GridX Model to manually calculated annual bills for a sample of 823 accounts for the transition rates and for all other rates for which the customer was eligible. This comparison shows that the maximum difference between the annual bill amount calculated by GridX and the manually calculated

---

[31] APS Response to Staff Data Request No. 11, Question No. 3(c).
[32] APS Response to Staff Data Request No. 11, Question No. 3(m).

annual bill amount was less than $1 per year and there were few instances in which there was a difference of even this magnitude.

Similarly, in spreadsheet APSAR00687 prepared on January 18, 2018, the Company compared the GridX MEP rate recommendation to the manually calculated MEP rate recommendation for a sample of 1000 customers and was able to confirm the GridX calculation for 999 accounts. In that case where a different MEP rate recommendation was observed, the difference between the MEP rate recommendation calculated by hand and that one calculated by GridX was $2.48, essentially the same.

This review concludes that these tests were adequate to ensure that the model was functioning properly when it was launched in August 2018, and Energytools could find no evidence to suggest that the Initial Tool was not providing accurate rate comparison information at that time. However, on February 4, 2019, an error was introduced into the Initial Tool when APS updated its MDM system. The APS MDM is a separate software package purchased from a different vendor and is where customer usage information is stored. This update triggered the need to rebuild the link integrating APS's data with the GridX rate comparison tool.

Unfortunately, there was an error in the integration. All hours were shifted by one hour because of this integration. Hence, the integration mapped on-peak hours as 2:00pm to 7:00pm, rather than the actual on-peak hours of 3:00pm to 8:00pm. This error was only present in the hourly data relayed to GridX to use in the rate comparison tool and did not affect APS billing which is based on meter register data as the billing determinants. This error therefore affected estimates for those residential customers who were considering and selecting a time-of-use rate plan or a demand rate plan using the tool,[33] and this error continued to affect the best rate plan recommendation for customers using the GridX initial rate comparison web tool until November 14, 2019, when the Company realized that there was a data transfer error to the Initial Tool and removed the tool from its website.

This evidence is consistent with issues reported by customers over the period between February 4, 2019 and November 14, 2019. Users of the Initial Tool reported three specific errors during this time. First, on June 6, 2019, a customer reported that he was unable to access the Initial Tool through aps.com. As discussed below, the Company has acknowledged that this was an issue. Then, on November 14, 2019, a customer reported two additional errors: (1) the Tool was not using the correct data to perform

[33] Response to Staff Data Request No. 11, Question No. 3(d).

calculations; and (2) the Initial Tool was making incorrect plan recommendations. Recognition of these errors led to the Company's decision to remove the Initial Tool from its website.

The above discussion supports the following findings with respect to the development, implementation and testing of the Initial Rate Comparison Tool:

Finding II-1. The testing that APS performed to ensure that the model was functioning properly when it was launched in August 2018 was adequate, and Energytools could find no evidence to suggest that the Initial Tool was not providing accurate rate comparison information at that time.

Finding II-2. On February 4, 2019, an error was introduced into the Initial Tool when APS updated its meter data management system and integrated that system with the GridX Model. This error compromised the ability of the Initial Tool to provide accurate MEP recommendations. Had APS performed the same level of testing on the Initial Tool at that time as was employed when it was initially introduced, this error would have been identified. APS bears full responsibility for not identifying this error at that time.

4. DETAILED EVALUATION OF POTENTIAL INITIAL TOOL ISSUES

As discussed above, this review has identified three areas that could potentially compromise the accuracy of the MEP results obtained by using the Initial Tool:

- Model Availability – The model was accessible to customers through aps.com. If customers were unable to access the model, then the model was not performing as anticipated. This is a known problem, based on two pieces of information. First, a customer complaint filed on June 6, 2019 in Docket No. E-01345A-18-0002 charges that the customer was unable to access the model and that this had been a persistent problem since "almost a year ago."[34] Furthermore, APS has acknowledged in a response to an inquiry from Commissioner Kennedy that "[t]here were times in 2017 and early 2018 when customer use of the tool exceeded its bandwidth, preventing customers who wanted to access the tool from doing so."[35]

- Meter Data Management ("MDM") System/Data File Transfer – The MDM system consolidated the hourly/15-minute reads from individual customers into a set of billing determinants from which bills could be calculated. After the data were consolidated into billing determinants, the resulting billing determinants were transferred to the GridX model for processing into typical (pro-

[34] See Consumer Comments/Letters – Miscellaneous, filed in Docket No. E-01345A-18-0002 by Steve Neil on June 6, 2019.

[35] See APS response to Letter from Commissioner Sandra Kennedy filed December 19, 2019 in Docket No. E-01345A-19-0003, page 2.

forma) bills under different rates. The Company has acknowledged that all hourly data flowing to GridX was shifted out by one hour (the data field indicated for 3pm data was actually 2pm data, etc.),[36] and these were used by GridX to develop the TOU billing determinants for the initial tool.[37] The analysis reported in Chapter IV quantifies the impact of this error on the rate class recommendations made by the APS.

- GridX model – This is the tool that APS utilized for purposes of providing service plan education for customers and for comparing the cost of all eligible residential service plans based on the customer's historical usage. "The GridX comparison tool allowed customers to make an informed decision about which service plan was the most economical so customers could decide what best met their needs and allowed the Company to provide customer-specific messaging and energy-saving tips."[38]

There were also two additional complaints related to the Initial Tool that were enumerated in a December 13, 2019 letter from Commissioner Kennedy to APS and filed in Docket No. E-01345A-19-0003.[39] These complaints related to the following issues that are also evaluated here:

- Consistency of Historical Bill Data and Initial Rate Comparison Tool Data – Commissioner Kennedy's letter documents customer complaints that there was a discrepancy between actual historical charges and charges as estimated by the Tool and that the Tool did not use actual billing data.
- Non-AMI and Solar customers' inability to use the tool - Three customers expressed frustration with their inability to utilize the online rate comparison tool due to their status as non-AMI or solar customers.

This section provides a detailed analysis of these issues related to the Initial Tool and contains findings related to this evaluation.

Initial Tool Access Through aps.com

As described above, Energytools was able to identify two Initial Tool issues that were related to issues with the Company's website, aps.com: (1) the website did not always allow users to access the Initial Rate Comparison tool; and (2) customer use of the tool exceeded its bandwidth in 2017 and early 2018. To determine the frequency of occurrence of these issues, Energytools requested more complete documentation from APS in the form of its web logs from Staff Data Request No. 11, Question No. 3(f)(v). and Staff Data Request No. 12, Question No. 11.

[36] Interview with APS Staff, 7/23/2020.
[37] Response to Staff Data Request No. 11, Question No. 3(d).
[38] Response to Staff Data Request No. 11, Question No. 3(a)(ii).
[39] Letter from Commissioner Sandra Kennedy filed December 13, 2019 in Docket No. E-01345A-19-0003.

Web logs are large text files that record detailed information about all web pages accessed on a domain (e.g. aps.com). These files become exceptionally long files for high traffic websites, with an entry for each page served by the web server. While the format may change from web server to web server, they generally contain the following information:

- Identification of each web user through a unique IP address (e.g. 188.45.108.168).
- Date and time stamp.
- A web server command, e.g. GET, indicating that the web server is getting a page from its hard drive and sending it to the web user. It could also be 'POST', which takes and records information from the user. The web command is followed by an HTTP address, e.g. http://www.almenland.at/almhuetten-mit-naechtigung.html, which corresponds to a file on the web server.
- A series of GET commands triggered by the contents of the HTML file requested, which access various other files on the web server, necessary to show a completed web page to the web user. Some GET commands can run files on the web server to access database information to show to the web user.
- A code indicating the result of the web server command, e.g. 200, showing a successful retrieval (from the web server hard drive) and delivery (to the web user) of information. The number following the 200 code typically shows the length of information delivered in bytes. A 404 code means 'Not Found', which means the requested information/file was not available (temporarily or permanently) on the web server.
- There is also detailed information about the web user, namely the type and version of web browser, device, and operating system that they used to access the information.

This web log information can be augmented with login information for each user to determine the identity of each web user. In this form, it would provide very detailed information on the experience of the web user, as it would indicate how the users flowed through the web site over time, requesting which pages, including how much time they approximately spent between consecutive web page requests. However, it does not necessarily indicate how much time was spent each web page, as the web user can shut down the browser at any time, and the browser would not send any data to the web server to indicate this. Given a detailed web log from aps.com related to access to the initial web tool, it would have been possible to determine which web pages were utilized by each web user. Given the HTML content of the web page, along with the databases that it accessed, it would have been possible to recreate all the information that each user saw (or did not see, if they got a 404 error), and determine exactly when they changed their rate class (which would be typically visible with a POST command).

In order for the current analysis to precisely quantify web site availability, whether the MEP rate recommendations provided by the Initial Tool were accurate, and whether customers acted on incorrect information provided by the Initial Tool, detailed web logs are needed that allow for ex-post tracking and evaluation. However, as a web log, APS only provided two sets of data related to people who have used GridX: one is 165,950 log records for 104,894 unique SA_IDs (Excel file 791), showing only a date/time stamp, and the SA_ID and ACCT_ID for the customer who accessed the GridX tool. The dates range between January 30, 2019 and November 1, 2019. Hence, the log does not contain any information related to which web comparison tool pages were accessed, what content the user saw, or whether the user was able to successfully see rate comparison information. The file is not a typical web page access log, which would show the date and time of each web page accessed, whether the web page was delivered successfully by the server to the user, and how long the delivery took.

APS has claimed that it does not have any web logs related to the web tool, despite the GridX information being shown under the aps.com website. All public companies typically maintain detailed web logs related to web traffic, and they do so especially on their main web domain. The provided web log data has multiple entries for some of the same SA_IDs, 11,881 of them have 3 or more entries, 3,818 of them have 5 or more entries, and 601 of them have 10 or more entries, suggesting that some users used the GridX tool multiple times, possibly due to the fact that they were not able to access the web tool easily, or because they wanted to recheck information on the web tool.

APS additionally provided Excel files 816 through 820, which show billing data for 104,913 unique SA_IDs who used the GridX tool, whether or not they changed their rate class using the tool. These data do not indicate when each customer used the web tool – they only show when their rate class changed over time. Energytools checked the web log (Excel file 791) against files 816-820 and found them to be consistent – there were only 31 accounts that were in 816-820 files that were not in the web log.

Finding II-3. APS.COM did not log the initial rate recommendation website, or the data that it served, which was based on information from GridX and contained pages that were populated and served by GridX. This has resulted in the shortcoming of not being able to fully determine the flow of customers to the tool, determine and tally their user experience, and evaluate the exact information that they were presented before making a rate change decision.

Development of Billing Determinants from Interval Data/Transfer of Billing Determinants to the GridX Model

As discussed above, in early February 2019, APS updated its meter data management system, which triggered the need to rebuild the link integrating APS's data with the GridX rate comparison tool. When the link was rebuilt, an error was built into the link such that all hourly data was shifted by one hour, and on-peak hours were considered to be 2:00pm to 7:00pm, rather than 3:00pm to 8:00pm, significantly affecting estimates for those residential customers who were considering and selecting a time-of-use rate plan or a demand rate plan using the tool. Quantification of the impact of this error is the subject of Chapter IV of this Report.

Finding II-4. There was an acknowledged mismatch between the TOU periods of the TOU rates and the TOU periods that were used to develop billing determinants for the GridX model. This mismatch was significant enough to cause the GridX model to make incorrect recommendations related to the "best" rate plan for customers who accessed the model. Based on the methodology discussed in Chapter IV, the potential impact to customers because of this error is $479,338.

5. GRIDX MODEL CALCULATIONS

When the Company's Residential Rate redesign, authorized in Decision No. 76295, was implemented on August 19, 2017, the primary calculation engine for comparing customer bills under each customer's eligible rate options was the GridX rate comparison tool. As indicated by the Company in response to discovery requests from Energytools, the GridX rate comparison tool was developed to provide service plan education for customers, add functionality, and reduce the system processing constraints and limitations of APS's previous rate comparison tool. For example, the rate comparison tool before the GridX tool allowed a customer to compare only two service plans at a time and the tool was slower in performing these computations. In contrast, the GridX tool compared the cost of all eligible residential service plans based on the customer's historical usage and returned these results almost instantaneously. The GridX comparison tool allowed customers to make an informed decision about which service plan was the most economical so that customers could decide what plan best met their needs and allowed the Company to provide customer-specific messaging and energy-saving tips.[40]

[40] APS's response to Staff Data Request No. 11, Question No. 3(a).

APS became aware that the GridX rate comparison tool may have been generating incorrect information on November 14, 2019, and immediately removed the tool from its website. APS learned of potential calculation errors within the tool through customer communications with the Commission, and independently verified that the tool was not working as expected due to the integration error discussed above.

Finding II-5. Based on APS representations and Energytools' independent analysis, there is no evidence that the GridX model itself was performing incorrectly or generating incorrect information. Rather, any identified errors were the result of improper inputs being provided to the model through an improper mapping of the TOU billing determinants. The impact of these errors is quantified in Chapter IV.

Consistency of Historical Bill Data and Initial Rate Comparison Tool Data

Two separate issues have been raised with respect to the consistency of the historical bill data and the results generated by the Initial Tool. With respect to the historical bill data, it is important to recognize that the Residential Rate Redesign that caused the need for the Initial Tool relied on different TOU rating periods than those that had been in place prior to the implementation of the new rate designs. Therefore, prior to August 2017, there would necessarily be a discrepancy between historical billing determinants shown on customer bills and billing determinants used to evaluate the impact of alternative rate designs for some customers. Another way of stating this is that historical billing data for the new TOU periods did not exist when the Initial Tool was launched and therefore could not have been used. Hence, the use of interval data to generate the new billing determinants, as discussed above.

Furthermore, after 2017, the historical bill data and the data used by the Tool will not necessarily match because billing data is on a more reliable register data basis and the Tool relied on interval data. But these data differences should not affect the MEP recommendations provided by the Tool because the Tool is designed to be "directional" rather than to provide a precise duplication of a customer's historic bills. If new data were consistent across all rate comparisons, then the MEP recommendations would be correct, even if the amounts calculated for the bills do not precisely match historical bills.

Similarly, the Tool's use of billing determinants that were different from those used to generate historical bills would necessarily result in different historical bills when new rates were applied. But again, this does not necessarily imply that the Initial Tool was faulty. Rather, the Initial Tool was designed to advise customers of the MEP on a going forward basis, using historical usage patterns and new rate designs. The only way to do this was to rely on the new rate designs and associated billing determinants, even if the resulting comparisons produced information that was different from the information on historical bills.

Finding II-6. Energytools has been unable to uncover any evidence that the Initial Tool was using information that was not consistent with historical data, except for the integration issues discussed above. Energytools has also been unable to uncover any evidence that the Initial Tool was generating bill comparisons whose differences from historical bills cannot be explained by differences in data inputs used to perform that function.

Inability of Non - AMI and Solar Customers to Use the Tool

Certain customers documented in Commissioner Kennedy's letter expressed frustration with their inability to utilize the online rate comparison tool due to their status as non-AMI or solar customers. The Company has acknowledged this deficiency, stating that "the online tool is unable to accurately model a solar customer's most economical plan because it cannot accurately project solar production. Similarly, non-AMI meters do not track customer usage data and therefore the tool is unable to model a rate recommendation. However, solar and non-AMI customers can speak to APS's customer service team members, who have manual tools to assist customers in identifying their most economical plan."[41]

Finding II-7. Energytools agrees with the Company that a lack of accurate data prevented non-AMI and solar customers from using the Initial Tool. However, this is not a shortcoming of the Initial Tool, but rather a lack of reliable data that would allow users to exercise the Tool properly.

6. CONCLUSION

This chapter of the report documents the Energytools review of the Initial Tool. Based on that review, we believe that the GridX model performed correctly and would have provided reliable MEP rate recommendations had it been provided with accurate billing determinants. We further believe that any misinformation provided to model users was the result of errors in the other processes, specifically the integration of the data warehouse and the GridX model itself, and we believe that APS bears full responsibility for not testing the integration more fully when it was implemented and ultimately for the any bad MEP recommendations that resulted from this error. However, because of a lack of web log

[41] APS response to Letter from Commissioner Sandra Kennedy filed December 19, 2019 in Docket No. E-01345A-19-0003, page 2.

information, it is impossible now to unequivocally confirm these findings, primarily because there is no record of the results that the Initial Tool produced, nor of the recommendations it made. Energytools recommends that, in the future, APS should implement full web logging related to information pages that are/can be used for the customer to make rate class change decisions.

Because detailed web log information is not currently available, Energytools has developed a ratepayer impact quantification framework that does not depend critically on information that might have been contained in the web logs. The quantification framework is discussed in detail in Chapter IV of this report.

III. EVALUATION OF THE NEW TOOL

1. INTRODUCTION

As indicated in the prior chapter, upon becoming aware of and confirming the reported errors in the Initial Tool on November 14, 2019, the Company removed the Initial Tool from its website. In its place, the Company provided a New Tool on January 29, 2020. The primary difference between this Tool and the Initial Tool is that the new rate comparison tool uses a customer's actual billing usage and information obtained from APS's billing system (the Customer Care and Billing "CC&B" system) to calculate the most economic rate plan. These data compare to interval data, which provided the billing determinants for the Initial Tool.[42]

For billing purposes, the customer's meter sends the customer's aggregated on-peak and off-peak usage data to APS using the proper on-peak hours. Then, the APS billing system uses these actual meter reads to bill a customer on the rate in which the customer is enrolled based on the customer's actual consumption. After a customer's bill is created, CC&B uses the same meter read data and the billing engine to consider the customer's energy use against all possible rates. This pro-forma billing considers up to the 12 most recent months of the customer's actual usage, calculates the customer's most economical plan based on this usage and, if appropriate, inserts a bill message to the customer recommending the most economical plan with potential savings based on the customer's historical use of energy.[43]

While discovery of the error required the replacement of the Initial Tool, the Company was already planning to do so by November 14, 2019 when the error was recognized. The replacement was necessitated by Commission Decision No. 77270 in Docket No. E-01345-19-0003, which required pro-forma billing.[44]

Before the New Tool was formally launched, the Company contracted with The Brattle Group ("Brattle") to verify the accuracy of the web tool's output (referred to as the "audit"). Using customer data and rates information provided by APS, Brattle verified the accuracy of the tool's recommendations regarding the rates that would have minimized customers' historical bills by independently replicating the underlying

[42] APS Response to Staff Data Request No. 11, Question No. 4(a).
[43] Ibid.
[44] Ibid.

calculations supporting those recommendations.[45] The Commission has requested that Energytools provide an independent assessment of the analysis of the tool performed by the Brattle Group. This chapter of the report provides the results of that analysis, as well as the results of the analysis of the revised Rate Tool to ensure the accuracy of its results. With respect to the Commission's RFP, this chapter addresses the following major work elements:

5) Perform a thorough and independent review and assessment of an analysis and report by the Brattle Group, APS's consultant, regarding Brattle's evaluation and testing of the Tool and its impacts on ratepayers.

7) Review, analyze, test, and evaluate the revised Rate Tool to ensure the accuracy of its results.

8) Develop recommendations regarding how to assist ratepayers in order to ensure that they understand how to use the revised Tool. Such recommendations should include an evaluation of how possible changes to the current rate plan names (i.e. Savers Choice, Savers Plus, etc.) might reduce confusion, and contribute to enhancing consumer understanding of, and decision making regarding available rate plan choices. Identify any disclaimers that should be given to users of the revised Tool in order to assure that Tool users understand the limits to which such a tool can provide accurate forecasts of future customer bills, given that changes in customer behavior cannot be factored into the Rate Comparison Tool analysis.

The anticipated result of this effort is a thorough review and assessment of analysis and evaluation of the New Tool that was done by the Brattle Group and its impacts on ratepayers.

2. ANALYSIS OF THE BRATTLE REPORT

The Brattle Report, initially filed in Docket No. E-01345A-19-0003 on January 15, 2020[46] concludes that:

> Based on our audit, APS's new web tool is accomplishing the company's intended objective of providing customers with accurate information about the rates that would have minimized their bills based on historical usage patterns. We have not identified any errors in the web tool's bill calculations that would result in customers being given misleading information.[47]

To test this conclusion, Energytools examined two key components of the Brattle analysis: (1) the analysis methodology employed; and (2) the analysis results and the conclusions drawn from those results. The Energytools evaluation of these two components is described in the subsections below.

[45] The Brattle Group, "An Assessment of APS's New Bill Comparison Web Tool," January 23, 2020, page 1.

[46] A revised version of the Report was filed on January 24, 2020 to correct the reported number of customers in the sample that are eligible to use the tool. As indicated in the Company's transmittal letter accompanying that Report, "[t]his understatement does not affect Brattle's findings, and has no impact on Brattle's conclusion confirming the accuracy of the rate recommendations in APS's web tool for each eligible customer in the sample.

[47] Ibid., page 2.

Analysis of the Brattle Methodology

As described in the Brattle Report, a five-step methodology was relied upon to evaluate the accuracy of the new bill comparison tool:

- Step 1: Establish a representative sample of customers
- Step 2: Obtain customer data for the sample
- Step 3: Independently develop a customer bill calculator
- Step 4: Obtain APS web tool output for full sample of customers
- Step 5: Compare and reconcile APS web tool output to Brattle's independent calculations[48]

The Energytools analysis of each of these steps is described in the following subsections.

Step 1. In Step 1, Brattle began with a sample of 55,343 randomly selected residential service accounts which, after eliminating ineligible accounts, resulted in a final sample of 47,440 residential service accounts.[49] The Brattle Report states that these 47,440 accounts were deemed to be representative of a range of billing characteristics similar to those of a broader population of residential customers for two reasons. First, the sample size "significantly exceeds utility industry sampling for load research,"[50] and second, "the sample and the full customer base exhibit a similar distribution of customers across rate classes."[51] Energytools agrees with these observations, and further agrees with Brattle's overall conclusion that "the sample is likely to represent a range of customer billing characteristics similar to those of the broader customer population, and is therefore sufficient for auditing purposes."[52] As a consequence, this evaluation of the Brattle analysis analyzes the same sample of customers.

In order to make an independent assessment of the Brattle Group report, and hence to validate the calculations performed by the New Tool as they were evaluated by Brattle, Energytools asked APS to provide the data that they provided to Brattle. This APS data was provided in 5 separate files, which included monthly billing data, for 55,343 customers.[53] For each customer, the data contains 5 or 6 records for each rate class per month, each indicating the bill amount that the customer would be charged if they were under that rate class, a column indicating which of these rate classes the customer is currently on,

---

[48] Ibid., page 3.
[49] Ibid., page 4.
[50] Ibid., page 4.
[51] Ibid., page 4.
[52] Ibid., page 5.
[53] The raw data contained 55,396 unique accounts by SA_ID. SA_ID is the unique system-generated identifier for a Service Agreement in the Company's CC&B system. The Service Agreement is the contract between the customer and APS for a specific service. After filtering out monthly data that did not pertain to the new rate classes, we reduced the data to 55,343 service accounts, the same number as used in the Brattle analysis.

and a difference column indicating how much more (or less) the customer would pay under a different rate class, compared to the rate class that they are currently on.

Energytools completed the same distribution calculation[54] and obtained the following results:

Exhibit III-1

Rate Class	Total Population		Brattle Sample		Energytools Sample	
	Share of Total Count	Average kWh/month	Share of Total Count	Average kWh/month	Share of Total Count	Average kWh/month
R-2	7%	1,202	7%	1,159	6%	1,187
R-3	18%	1,659	14%	1,637	14%	1,683
R-Basic	11%	780	11%	785	12%	787
R-Basic-L	3%	1,438	3%	1,449	4%	1,415
R-TOU-E	36%	1,098	36%	1,073	37%	1,107
R-XS	25%	441	28%	445	27%	435

Step 2. Brattle acquired the customer data needed to calculate bills for each customer in the sample in Step 2. As indicated above, Energytools relies on this same data set in its analysis.[55]

Step 3. In Step 3, Brattle independently developed a customer bill calculator for comparison to the web tool output in Step 4. To verify the calculations, Energytools also independently developed a customer bill calculator. In this endeavor, we strived to verify more than 99% of the calculations as a benchmark of verifying the results, and included as many billing rates, riders, rounding rules and other billing calculation rules as needed to exceed this precision. Because of this approach, Energytools did not, and never intended to, duplicate the Brattle results exactly. Rather, our intention was to confirm the MEP selection without having to include all miscellaneous charges from the bill and Company-specific bill calculation rules. Nevertheless, treating each record in the dataset separately, our results are as follows: In terms of dollar differences, Energytools is within 1% of the APS/Brattle calculated bill 99.39% of the time, and within 2% of the APS/Brattle calculated bill 99.74% of the time. In terms of MEP differences, our

[54] APS indicated that the table found on page 4 of the Brattle report was provided by APS to demonstrate that the sample population was representative of the full population. APS queried all residential APS customers for the time period of Nov 2018 to Oct 2019 and provided the customer counts by rate class as well as the average monthly kWh/customer by rate class to then be compared to the same results for the Brattle sample of aggregated test files. Our calculations do not filter the data for Nov 2018 to Oct 2019 nor for rate class eligibility, but still result in the same distribution within 1 percentage point of the distribution in the Brattle report.

[55] APS Response to Staff Data Request No. 15, Question No. 1.

independent analysis matched the APS calculated MEP in 99.35% of the cases.[56] In the cases where the Energytools analysis does not match the Brattle/Company analysis, almost 90% of those cases are within $1 of the MEP, and almost 98% of those cases are within $5 of the MEP. From this, we conclude that we have duplicated the Brattle/Company results with sufficient precision to verify the accuracy of the calculations of the New Tool.

Step 4. As did Brattle, Energytools requested the APS web tool output for the full sample of customers so that the results of the independent valuation performed in Step 3 could be compared to the APS web tool results.[57]

Step 5. In this final step, Brattle compared and reconciled the APS web tool output to its independent calculations. The results of this step are summarized in the next section of this report and a verification of these results involves a comparison of the Energytools independent results to the Brattle results. Obviously, if the results are the same, the Brattle analysis has been validated as has the New Tool's calculation of typical bills and MEP recommendations.

Finding III-1. Energytools agrees with the methodology employed by Brattle to validate the accuracy of the New Tool. It relies on the same steps that Energytools itself relies on to independently validate the accuracy of the New Tool. Furthermore, Energytools agrees with the Brattle Report statement that the sample of accounts that it relied on to validate the accuracy of the New Tool are representative of a range of billing characteristics similar to those of a broader population of residential customers.

Analysis of the Brattle Results

As indicated above, Brattle began with a sample of 55,343 randomly selected residential service accounts and attempted to calculate monthly bills for all customers in its sample. However, the monthly bill calculations could not be developed for 7,903 customers because of insufficient (less than three months) data and 1,395 customers because of some other data limitation:

- Customers whose historical bills under alternative rates were being computed assuming different status codes and flags than those that were used to compute the actual bill
- Customers that were disconnected for fewer than 5 days, but then resumed service under the same service account ID[58]

[56] Since the data provided is monthly, all Energytools MEP calculations and comparisons are done on a monthly basis. APS indicated that its web tool sums the data we evaluated on a rolling 12-month basis to show the MEP to the customer.

[57] Staff Data Request No. 13, Question No. 1(c) and Question No. 3(b) of the Staff Informal Data Request issued on July 14, 2020.

[58] The Brattle Group, "An Assessment of APS's New Bill Comparison Web Tool," January 23, 2020, page 7.

These (7,903+1,395=) 9,298 were eliminated from further analysis by Brattle as customers with these characteristics are not eligible to use the Tool. Calculated bills for the remaining customers in the sample matched for all but 378 monthly bills, corresponding to 47 customers in its sample. Brattle performed further analysis on these customers and discovered that they were also ineligible to use the Tool because of: (1) a discrepancy in alternative bills due to inconsistent treatment of charges which change mid-month, specifically the Lost Fixed Charge Recovery Mechanism ("LFCR") and certain county taxes (28 customers); (2) a discrepancy in alternative bills related to bill cycle timing for some Preferred Due Date customers (16 customers); and (3) a discrepancy of a customer's actual data with test environment data (3 customers).[59]

Finding III-2. Although the Energytools evaluation of the Brattle analysis did not require a specific identification of the customers in each of the above groups, Energytools agrees with Brattle's treatment of these customers in its analysis.

3. ANALYSIS OF THE REVISED RATE TOOL

After completing the above analysis steps, Brattle developed the following conclusions considering the results that they obtained:

> Based on our audit, APS's new web tool is accomplishing the company's intended objective of providing customers with accurate information about the rates that would have minimized their bills based on historical usage patterns. We have not identified any errors in the web tool's bill calculations that would result in customers being given misleading information.[60]

Energytools has independently performed its own analysis of the Brattle sample and has been able to duplicate the monthly rate recommendations developed by both Brattle and the Company. In terms of duplicating these bill calculations, we were able to reach a precision of 1% in 99.39% of the bills:

Exhibit III-2

BILL CALC DIFFERENCES	Number	Percentage
2% or more	1,796	0.06%
1% to 2%	1,719	0.05%
within 1%	3,202,942	99.39%
-1% to -2%	9,483	0.29%
-2% or more	6,668	0.21%
Total # of rate calc records:	3,222,608	100.00%

[59] Ibid., pages 7-9.

[60] Ibid., page 9.

In terms of duplicating the MEP recommendations in monthly bills, we were able to reach agreement on 99.35% of the recommendations:

Exhibit III-3

MEP DIFFERENCES	Number	Percentage
MEP Match	635,776	99.35%
No Match	4,143	0.65%
Total number of monthly bills:	639,919	100.00%

Finally, among the cases where we were not able to match the MEP, our calculation was within $5 of the indicated MEP 98% of the time:

Exhibit III-4

$ DIFFERENCE FROM MEP[61]	Number	Percentage
Less than $1	3,693	90%
Between $1 and $5	314	8%
Larger than $5	102	2%
Total:	4,109	100%

If one were to assume the records within $5 of the MEP as successful calculation matches,[62] the overall success in duplicating APS's calculations is (635,776+4,109-102)/(635,776+4,109) = 99.98%.

Finding III-3. Energytools has found no errors in the Brattle analysis results based on its own independent evaluation of the Brattle dataset. Based on this analysis, Energytools agrees with the conclusions that Brattle has reached in its analysis of the New Tool.

Finding III-4. Energytools has been able to confirm the accuracy of the New Tool recommendations with 99.98% accuracy.

[61] After eliminating 34 records for customers on the old E-12 rate class from those records.
[62] Ibid.

However, as discussed in Chapter II, there were two other issues with the Initial Tool that caused it to make incorrect MEP recommendations: (1) meter data transfer issues; and (2) calculated billing determinants and bills that were not consistent with historical customer bills.

These Initial Tool issues have now been resolved in the New Tool because the New Tool relies on the same data to generate pro-forma bills as APS's CC&B system. This is shown graphically on Exhibit III-5, which shows the data flow and calculations of the New Tool. As can be seen there, the new process eliminates the data warehouse and the old rate comparison tool (GridX), thereby obviating the need for the data integration process that was faulty in the Initial Tool. Instead of these processes, data is transferred directly from the MDM to the billing system, which calculates current customer bills and bills under all eligible rates for each customer. This allows the Company to present a customer bill containing: (1) the current rate plan; (2) the MEP recommended plan; (3) the difference between the current monthly bill and the monthly bill under the MEP; and (4) the difference between the annual bill under the customer's current rate plan and the customer's annual bill under the MEP.

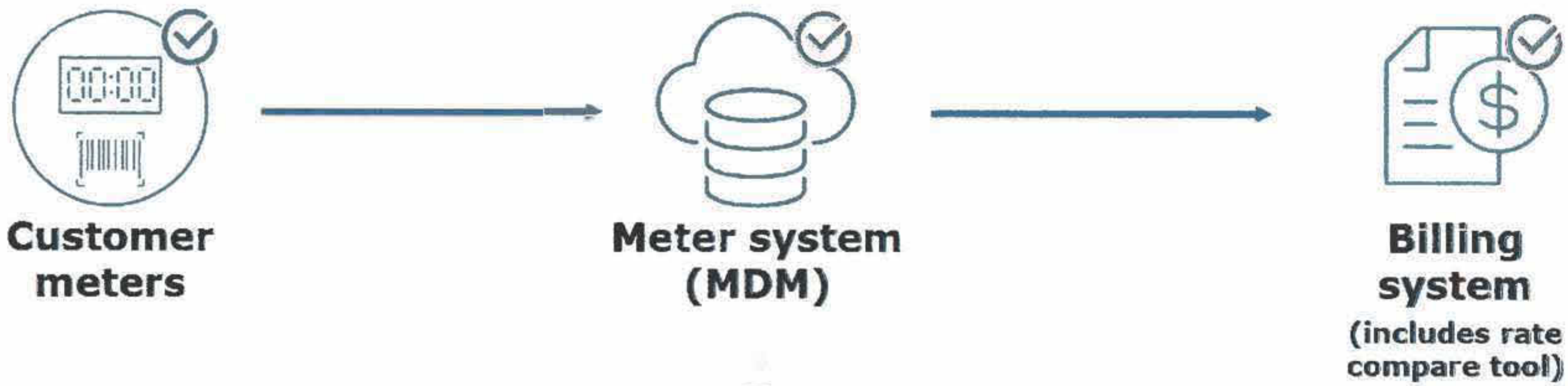
Finding III-5. The revised data handling and analysis processes employed by the New Tool resolve the meter data transfer issues that were present in the Initial Tool and also resolve the consistency problems between calculated billing determinants and bills and historical billing determinants and bills.

4. RECOMMENDATIONS REGARDING TOOL USAGE

As indicated above, the Commission has stated in its RFP that it would like recommendations regarding how to assist ratepayers in order to ensure that they understand how to use the revised Tool. This section contains these recommendations. They are grouped into recommendations regarding tool usage, rate plan names, and potential disclaimers that emphasize for ratepayers the strengths and limitations of the Tool recommendations.

Rate Comparison Tool – New Tool

CURRENT STATE



✓	*Fully functional*
⊗	*Functional issues*

aps

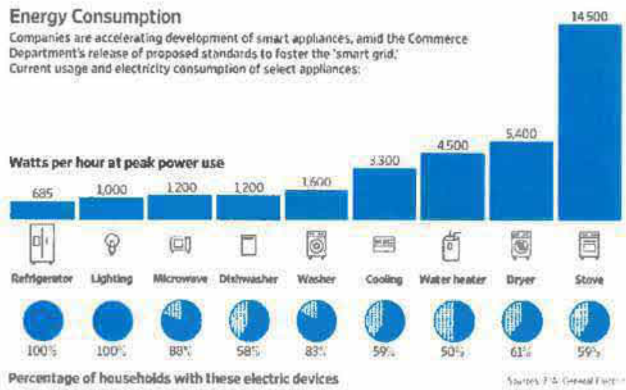
Energytools is aware that the Company is required, per Commission Decision No. 77270 (June 27, 2019), to "track and report ... on a quarterly basis the status of the Customer Education and Outreach Program, including stakeholder engagement efforts, customer plan selection, and any changes in usage patterns for customers since the implementation of the new rate plans"[63] and is also aware that the Company has established a customer working group which meets bi-weekly to develop the most effective way to present information about new rates and the Tool to customers.[64] The efforts documented in these filings are probably more useful for the Company and its ratepayers than the Energytools recommendations provided in this section of the report. However, we offer them as potential considerations based on our general familiarity with rate issues throughout the country. In addition to the recommendations related to the three areas indicated above, this section also provides a number of visual presentation recommendations for potential use on aps.com. These latter recommendations are based on a national perspective and may not be optimal for use by APS and its residential customer base.

Recommendations Regarding Tool Usage

Energytools offers the following six recommendations related to usage of the New Tool:

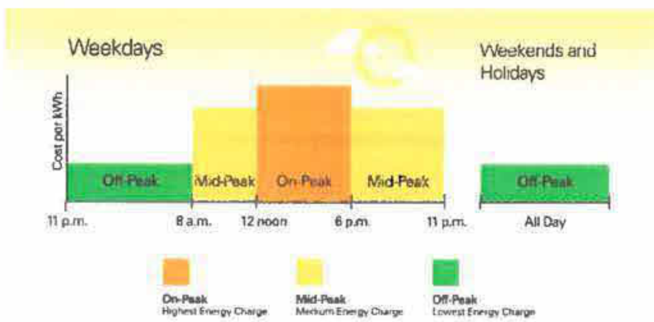
- Consider the implementation of an application or graphic showing ratepayers their levels of usage and peak usage (kWh, kW), along with specific recommendations on how to manage levels of both types of usage in order to maintain a reasonable demand charge for all the rate plans.
- Consider a high usage alert, compared to peers in the same rate class.[65]
- Consider providing information on the typical consumption of common appliances with an explanation of how to estimate peak demand to determine which time-of-use plan the ratepayer might be more comfortable committing to.
- Consider graphic/visual for ratepayer peak usage estimation, similar to the following:

[63] See, for example, the APS July 31, 2020 Compliance Filing in Docket No. E-01345A-19-0003.
[64] The Company also files the minutes from these meetings in Docket No. E-01345A-19-0003.
[65] For example, see https://www.duke-energy.com/home/billing/usage-alerts.



- Consider providing information on how future deviations in time-of-use could affect a ratepayer's choice of rate plan. Due to the increase in teleworking, customers who anticipate increased time spent at home should consider this apart from the Tool's recommendations.

- Consider the implementation of an infographic/graph for recommended plans by most common time-of-use for any customer, given an average electric demand. Include similar visual for all plans, as shown on the following graphic from SoCalEd:



Recommendations Regarding Plan Names

Energytools offers the following recommendations related to plan names:

- Consider further distinguishing Saver Choice from Saver Choice Plus and Saver Choice Max by changing its classification/name to a time-of-use plan without a peak demand charge.

- Elaborate upon nomenclature behind Saver Choice Plus and Saver Choice Max.

    - Plus: for consumers who are looking to move a moderate amount of power demand to off-peak hours

    - Max: for consumers who are able to move a high level of power demand to off-peak hours.

- Also indicate their load factor on the bills and recommend which rate class they should be on by load factor. (If LF=32% or above, typically Saver Choice Plus or Max is better than the other rate classes for them.)

Recommendations Regarding Potential Disclaimers

Energytools offers the following recommendations related to potential disclaimers related to Tool recommendations:

- Ratepayer forecasts are established based on average usage; therefore, consumers should be informed that any considerable changes in their actual usage cannot possibly be accounted for by the new rate comparison web tool.

- For customers switching to a demand-based rate plan, any significant peak charges as a result of extraneous circumstances (weather anomaly, or usage anomaly such as throwing a party) cannot possibly be accurately predicted by the Tool.

- Rate tool recommendations are based on normal weather patterns and, as a result, any statistically uncommon weather patterns cannot be forecasted and considered when determining a most economical rate plan.

- The rate tool is driven by prior customer usage and cannot forecast any accumulating charges due to alterations to a ratepayer's residence and/or the addition of electricity consuming appliances such as EVs.

- Any significant changes in ratepayer time-of-use due to outside circumstances such as with the increase in teleworking due to the current state of emergency cannot be factored into the web tool's estimates.

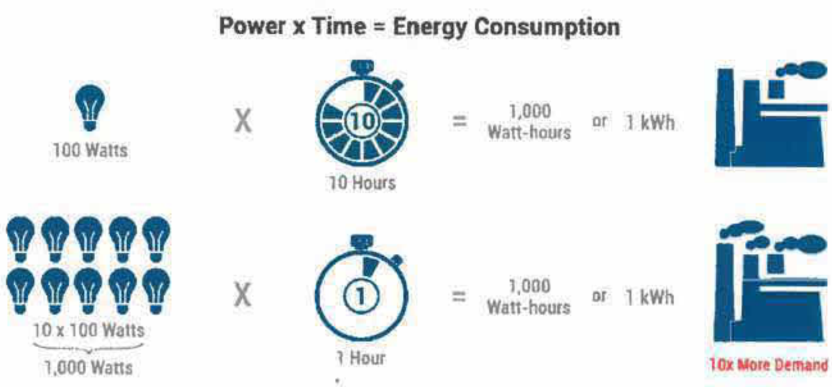
Visual Recommendations

It is important for ratepayers to understand how demand charges are accrued and accounted for in order for them to effectively manage their personal electricity consumption. Visuals such as the following could be strong aids to explain the demand charges accompanying certain usage patterns and could be implemented in order to assist in ratepayer awareness.

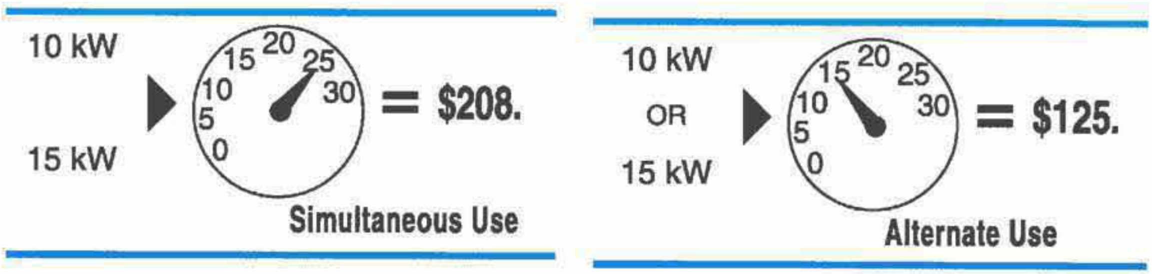
https://www.sdge.com/businesses/pricing-plans/understanding-demand

The infographic above would be specifically useful for ratepayers to visualize what staggering usage can do for their demand charges.

Consumers should also be advised that less usage does not necessarily equal cost savings when on a time-of-use plan. Example scenarios can also be used such as the following in order to further put into context the demand charges consistent with certain usage patterns:



https://www.capsells.com/understanding-kilowatts-and-kilowatt-hours/



https://www9.nationalgridus.com/niagaramohawk/non_html/eff_elec-demand.pdf

Under APS's rates for Saver Max with the highest kW charge, just the demand cost would be:

Without staggering:

- Saver Max: **$17.438** (summer peak kW) * **25 kW** (peak usage) = **$436**

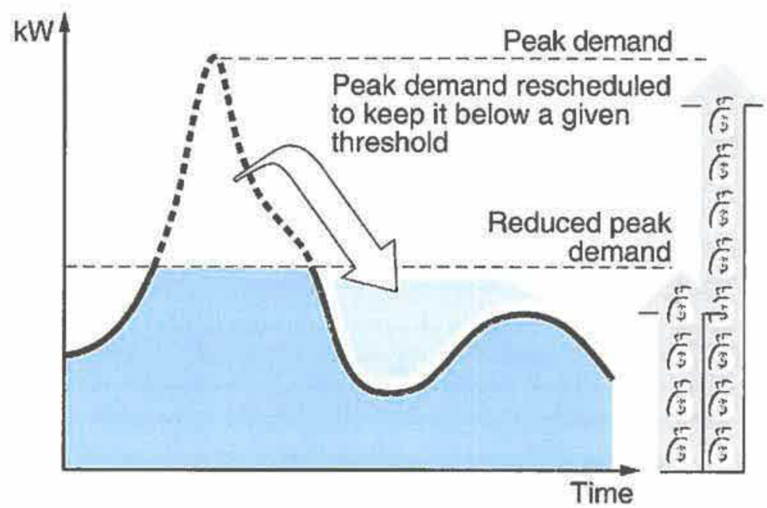
With staggering:

- Saver Max: **$17,438** * **15 kW** (new peak usage) = **$262**

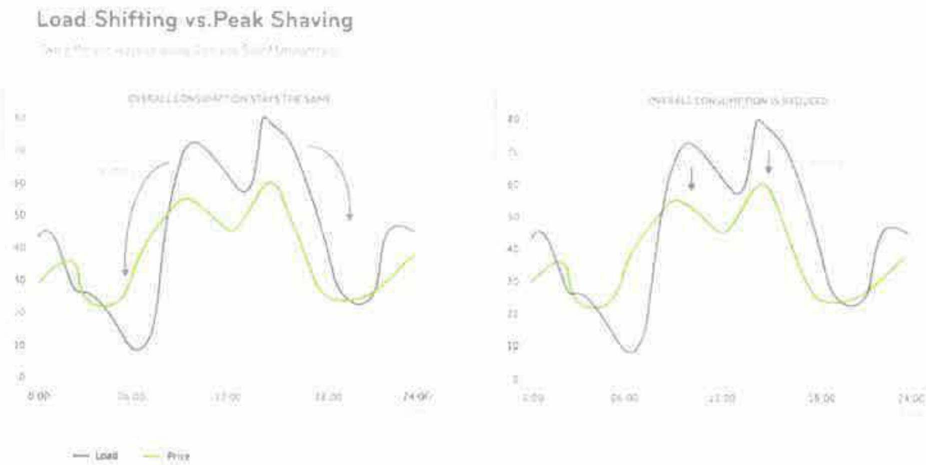
APS could use ratepayer usage history to compare maximum user peak charge with average user peak charges to illustrate potential demand charge savings per customer with staggering.

It is also recommended to highlight specific consumer behaviors since these do not necessitate knowledge of energy units and demand calculations. This makes infographics highlighting actions and usage habits a meaningful proxy to quantitative graphics since ultimately consumer behavior will most influence the ratepayer's bill.

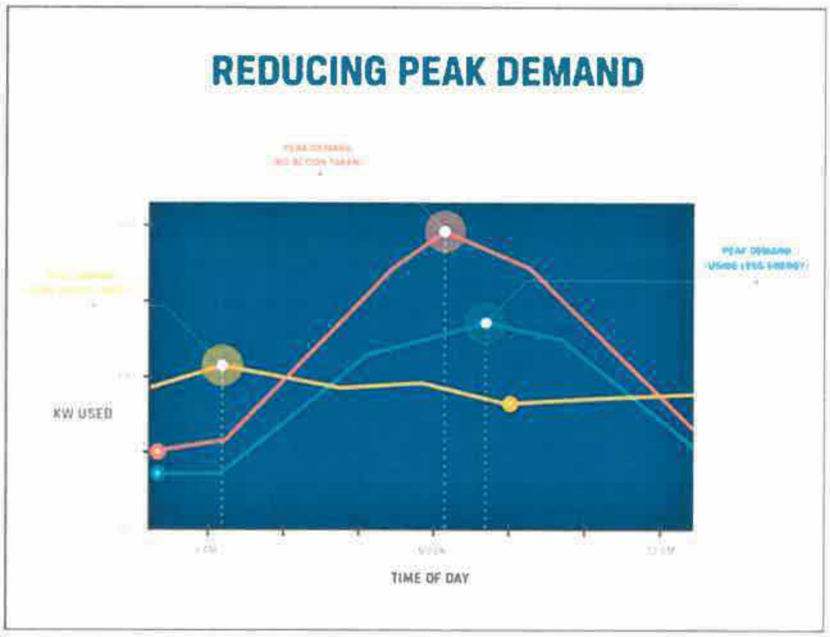
Energy Usage Based Visuals:



https://electrical-engineering-portal.com/smart-load-management-strategies-to-save-energy



https://www.next-kraftwerke.com/knowledge/what-is-peak-shaving

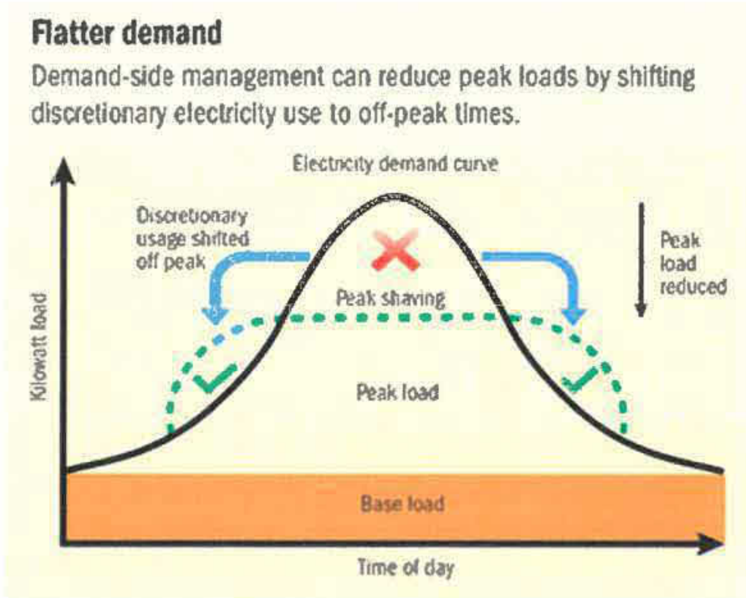


https://www.tpiefficiency.com/single-post/2018/07/02/what-is-a-peak-demand-day

By utilizing techniques such as shaving and shifting, customers can "flatten the curve" and transfer or eliminate their peak usage while maintaining the same overall energy volume. Infographics such as the above types can visually show this energy usage transfer while action items such as the ones below can detail the exact techniques/behaviors required to reduce peak demand charges. This is a highly recommended strategy since it does not require any significant level of comprehension of energy demand/usage. Rather, it outlines behaviors the ratepayer can abide by in order to reduce their usage passively. These recommended usage patterns can be presented in a similar fashion to the examples in the following subsections.

Action Item Visuals (most effective with customers who are not savvy in tracking their electricity kW/kWh usage):

https://www.gcea.coop/peak-demand-info

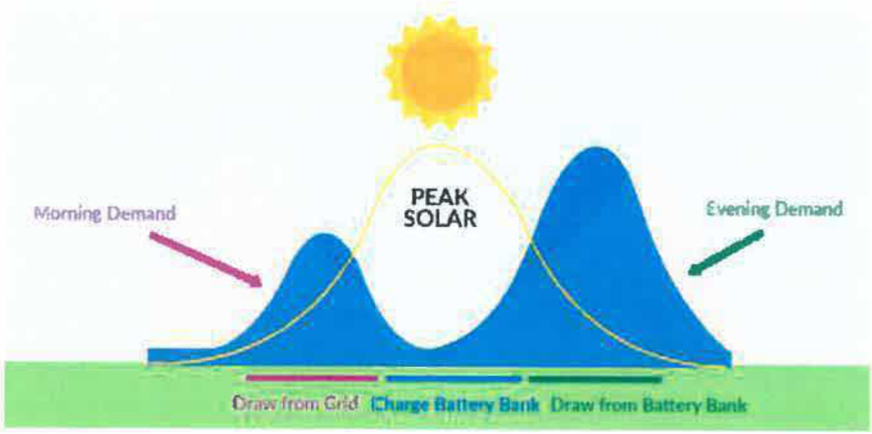


https://www.imf.org/external/pubs/ft/fandd/2015/12/jamal.htm

While education regarding the calculation and accrual of peak demand charges is probably helpful to consumers who are able to contextualize the information (as demonstrated in the earlier sections) the main advantage of action items is that it requires minimal interpretation on the part of the ratepayer. For example, by simply following the above action items, a customer would be able to (in theory) minimize their demand charges with little or no understanding of energy units and peak demand calculations.

Additionally, another method of consumer education could be information on specific energy saving appliances/applications beyond the usage patterns outlined above. For example, the installation of solar and smart technologies such as thermostats. Specific action items such as those below could work to further inform ratepayers on the potential savings attainable if they choose to alter their energy usage beyond just their behaviors.

http://electricitycommission.to/energy-saving-tips/



https://evannex.com/blogs/news/why-grid-storage-will-be-huge-on-both-sides-of-the-meter

A final measure of informing ratepayers on energy/cost saving measures assuming all ratepayer education is insignificant could be the implementation of smart meters in conjunction with a mobile/web application. By using such an application, consumers could be alerted when their energy usage exceeds their average usage in order to alert them in real-time what their usage levels are at if they are unable to remain vigilant throughout the billing period for those on time-of-use plans.

In conclusion, consumer education could span the vertical space from rate calculation to behaviors/appliances that specifically reduce energy usage. This includes but is not limited to four categories of information that can be provided:

- For savvy customers: Educational information based on actual and example data:
    - Demand charge calculations
    - Graphical energy usage

- For non-savvy customers: Checklists (things to do that are not necessarily based on data):
    - Action item with or without visuals
        - Behavior recommendations
        - Getting a thermostat
        - Other demand reducing behaviors
    - Energy saving appliances/applications

Having a combination of both types of customer education information seems to be the most effective method, since such an approach factors in the redundancy of multiple levels of consumer knowledge pertaining to energy output and consumption. Even assuming that a customer has zero knowledge of demand charge components, by following the behaviors recommended, customers should be able to successfully manage their energy consumption/peak usage.

5. CONCLUSION

After performing a detailed analysis of the report by the Brattle Group regarding Brattle's evaluation and testing of the Tool, Energytools agrees with the methodology employed by Brattle to validate the accuracy of the New Tool and further agrees with the conclusions that Brattle has reached in its analysis of the New Tool. Energytools has also confirmed the accuracy of the MEP recommendations of the New Tool through an independent analysis. Furthermore, Energytools believes that the revised data handling and analysis processes employed by the New Tool resolve the meter data transfer issues that were present in the Initial Tool and also resolve the consistency problems between calculated billing determinants and bills and historical billing determinants and bills.

Energytools has also developed recommendations regarding tool usage, rate plan names, and potential disclaimers that emphasize for ratepayers the strengths and limitations of the Tool recommendations. It is important to recognize that these recommendations are based on Energytools's general ratemaking knowledge and experience from a national perspective and are not intended to supersede any recommendations that the Company develops in conjunction with its customer working group and the efforts of that group are probably more useful for the Company and its ratepayers than the Energytools recommendations provided in this section of the report. However, we offer them as potential considerations based on our general familiarity with rate issues throughout the country.

IV. IMPACT OF THE INITIAL TOOL ERROR

1. INTRODUCTION

The Commission's RFP explicitly requests the following analysis related to the Initial Tool:

4) Completing an independent review of the information posted on the APS website to verify the accuracy of the reported information.

6) Complete an independent determination of the number of ratepayers who, when relying on the results generated from the Initial Tool, were not directed to the most beneficial rate plan; and calculate an estimate of the financial impact to these customers from this misdirection.

The results of this analysis are the subject of this chapter of the report.

With respect to an independent review of the information posted on the APS website to verify the accuracy of the reported information, Energytools has evaluated the accuracy of the rate recommendations from both the Initial Tool and the New Tool. As described more fully in Chapter II, the rate plan recommendations of the Initial Tool were compromised by incorrect data inputs to the GridX model from February 2019 to November 2019 and the Initial Tool did not always recommend the correct rate plan over this time period as a consequence. However, as described more fully in Chapter III, these data input deficiencies were corrected when the New Tool was implemented on January 29, 2020. Energytools believes that after this time (and prior to February 2019), the information posted on the APS website with respect to rate plan recommendations was correct. An estimate of the extent to which the rate plan information differed from correct rate plan information from February 2019 to November 2019 is contained in this chapter of the report. This difference is measured both in terms of the number of customers who received bad information and the estimated cost to these customers by reliance on this incorrect information.

With respect to quantification of the financial impact, the RFP clarifies this to be an independent calculation of amounts individual ratepayers would have paid had they been directed to the most beneficial rate plan, versus what they actually paid due to the Tool's misdirection.

This calculation is complicated by three factors:

1. The Initial Model (GridX) code is proprietary, so it is not possible to test the model directly, but only indirectly through data that GridX provided to APS over time.

2. As described above in Chapter II, there is no record of the recommendations made by the GridX Model, so there is no way to test the model by developing independent rate recommendations and comparing them to the rate recommendations made by the GridX Model.

3. APS no longer contracts for the use of the GridX model, so there is no opportunity to exercise it, develop rate recommendations made by the GridX Model, and compare them to independently determined rate recommendations.

Because of these factors, Energytools developed an analysis framework to quantify the overall ratepayer impact that relies on the following analysis issues workaround: The analysis determines the number of ratepayers who, after accessing the Initial Tool, did not ultimately go on the most economical plan (MEP) based solely on historical usage data. In this analysis, it is assumed that the reason the customer did not do so is solely because the model gave them bad information. The resulting estimate of ratepayer impact is most likely an "upper bound" estimate of the rate impacts caused by MEP recommendations from the Initial Tool for the following reasons:

- There may not be a big difference between bills under the customer's current rate plan and the "best" MEP rate plan. If the magnitude of the difference between bills under the "best" rate and the customer's current rate choice is small, then the customer is not likely to go to a new, and for him, unproven rate.

- The customer may not like features of their MEP, i.e. "best" rate choice, e.g., the customer may not like demand charges or the TOU peak period and is willing to pay a premium to avoid them.

- The "best" choice may not be obvious, i.e. their MEP may change over time. If the best rate choice for a customer does not remain the same for each annual period evaluated, then the customer is being completely rational by staying on a sub-optimal rate for some period, and any resulting negative ratepayer impact should not be ascribed to the model.

- Even if a customer is provided with a correct MEP rate recommendation based on historical consumption, consumption may change in the future in such a way as to render that recommendation incorrect. The resulting negative ratepayer impact should also not be ascribed to the model.

In order to recognize this acknowledged bias, sensitivity analysis is used in all subsequent analysis to place bounds on the likely ratepayer impact.

Three different ratepayer impact quantifications required by the Commission are developed and reported in this chapter of the report:

1. Customers were not always directed to the most beneficial rate plan by the Initial Tool because there was an acknowledged error in the calculation of the associated billing determinants (specifically, the 2-7pm vs. 3-8pm peak kW calculation). To quantify the ratepayer impact

associated with this error, two simulations are run using billing determinants developed assuming both TOU periods. The bill difference between the two simulations is the calculated upper bound on the ratepayer impact, subject to certain exclusions. The quantification metrics of this analysis are the number of customers who were misdirected, i.e. customers who either (1) changed their rate class <u>incorrectly</u> due to an incorrect MEP recommendation), or (2) did not change their rate class <u>potentially</u> because their incorrect MEP recommendation differed from the correct MEP, but it was the same as their rate class at some point in time during the February 2019 to November 2019 incorrect MEP recommendation period.

2. As indicated above, it is not known what recommendations the Initial Tool made. Therefore, as an upper bound on rate impacts, it is assumed that: (1) users of the Tool unfailingly followed the Tool's recommendation; and (2) any sub-optimal rate outcome was the result of the Initial Tool not providing the correct recommendation. Consequently, as a proxy for the number of ratepayers who were not directed to their MEP, we calculate, for those customers who relied on the Initial Tool (in the logs), the number that ended up on a "sub-optimal" rate for which they were eligible. Quantification metrics for this analysis are the number of customers on a sub-optimal rate and the total bill difference between their MEP (the "best" rate) and the rate these customers were on over the time period that they were "wronged" by misdirection to change to or to stay on a suboptimal, non-MEP rate class.

3. Because the above analysis probably overstates the impact of the Initial Tool error, it seems appropriate to also develop a lower bound(s) on the above results. This is done by using sensitivity analysis so that only in cases where the bills under MEP rates differ from bills under the chosen rates by more than 3% annually and over $10 monthly are included in the impact of the Initial Tool error calculation.

It is also important to bear in mind as this analysis is presented that APS did not keep track of tool access and recommendations, so it is not possible to know whether customers tried to access the Tool but were denied. To the extent that such customers exist and did not ultimately gain tool access, the overall quantification of the ratepayer impact could be higher.

2. QUANTIFICATION OF THE RATEPAYER IMPACTS OF THE INITIAL TOOL ERROR

This section describes the method by which Energytools quantified the ratepayer impact of the Initial Tool error and the results of applying this evaluation framework to APS customers who relied on the Initial Tool. In general, this quantification is developed in the following three steps:

1. For customers who have changed their rate class based on bad information, we assume damages occur beginning with the rate class change that was attributable to that bad information (from the 2-7pm vs 3-8pm peak kW shift).

2. For customers who have not changed their rate class (who have stayed) based on bad information, we assume damages occur beginning with the month where the incorrect peak

kW would have resulted in a rate class recommendation that was not their MEP, but same as the rate class that they were on.

3. Quantify the bill impact on customers by tallying the difference between their monthly payments under their rate class, and the MEP rate class, which we term the MEP difference.

For customers who have changed their rate class, the customer was considered harmed only if they changed their rate class from February 2019 to November 2019 based on incorrect information. For customers who have not changed their rate class, the customer was considered harmed only if they received an incorrect rate class recommendation from February 2019 to November 2019 that was the same as their current rate class, but was different than the correct rate recommendation that they should have received from a correct Initial Tool.

Since we do not have access to historical recommendations given by the Initial Tool, we assume that the customer was given bad information when there is a difference between any incorrectly recommended MEP (calculated based on shifted hourly data) and the MEP that would have been recommended based on the correct billing determinants.

In order to do this, for each customer in the Initial Tool log, we merged hourly data with their corresponding monthly bills, and calculated the difference between the 2-7pm peak kW and the 3-8pm peak kW based on hourly data, and applied that as a percentage to the billed peak kW from the customer's meter register. Exhibit IV-1 summarizes the statistics on the calculated kW.

Exhibit IV-1

Customers who changed to nonMEP	
kW diff	**Share of Bills**
-5 or more	0.38%
-4	0.35%
-3	0.76%
-2	2.21%
-1	6.87%
0	78.23%
1	7.66%
2	2.41%
3	0.73%
4	0.23%
5 or more	0.17%
Total:	**100.00%**

Customers who stayed on their rate class	
kW diff	**Share of bills**
-5 or more	0.61%
-4	0.41%
-3	0.87%
-2	2.22%
-1	6.50%
0	77.83%
1	7.86%
2	2.48%
3	0.76%
4	0.24%
5 or more	0.23%
Total:	**100.00%**

Note here that a shift in the peak kW figure does not necessarily trigger an incorrect MEP recommendation, as it requires the shifts to 'add up' to generate a shift in the MEP ranking of 12 month estimated total bills under each rate class.

To be harmed, the customer had to act on the bad information, and the harm to that customer is determined for the two distinct subgroups of customers as follows:

- For those customers who made a rate plan change, this is determined by whether the rate plan to which the customer switched was incorrectly recommended, i.e., was the "New" rate plan incorrectly recommended at any time from February 2019 to November 2019?

  For example, assume that a customer was switched by the Company to R-TOU-E in April 2018 and stayed on that rate. They then decided to switch to R-2 in November 2019 while their MEP was R-3. If any one of the incorrect rate recommendations they would have seen during February to November 2019 included R-2 (based on bad information as defined above), we ascribe the difference between their calculated monthly bill on R-2 and their calculated monthly bill on R-3 as potential damages going forward.

- For those customers who did not make a rate plan change, this is determined by whether the customer stayed on a rate plan that had ever been incorrectly recommended, i.e., was that customer's current rate plan incorrectly recommended at any time from February 2019 to November 2019?

  For example, assume a customer was on the R-2 rate class throughout 2019. However, in August 2019, based on our calculations, while both their <u>correctly</u> and <u>incorrectly</u> calculated MEP was R-3 up to that point, the incorrectly calculated MEP became R-2 while their correct MEP was still R-3. Since this resulted in bad information given to the customer, we ascribe potential damages for that customer beginning in August 2019 as the difference of their monthly bill between their correct MEP (R-3) and their incorrect MEP (R-2) going forward.

Total customer impacts are the sum of the differences between the customer's bill under their rate class, and their bill under the MEP. We sum these impacts for the period February 2019 (date of the model error and the first date on which any difference in model recommendations would show up) up to February 2020 (the month during which the New Tool was launched). These impacts are determined for the two distinct subgroups of customers as follows:

- For those customers who made a rate plan change, this is calculated as the sum of the monthly differences between their bills on the correct rate recommendation and the incorrect rate recommendation over the period from when they incorrectly switched their rate class until February 2020 (the last month for which rate impacts can be ascribed to the Initial Tool).

- For those customers who did not make a rate plan change, this is calculated as the sum of the monthly differences between the correct rate recommendation and the incorrect rate recommendation over the period from the first month that incorrectly recommends the current rate and January 2020 (the last month for which rate impacts can be ascribed to the Initial Tool). Any incorrect rate recommendations that were not the current rate that were made prior to the time that the model recommended the current rate are assumed to have been ignored by the customer and no rate impacts are ascribed to the model during this time period.

Based on all customers in the customer log provided by GridX (i.e. those who accessed the Initial Tool over the period in which it was potentially providing erroneous results), APS provided hourly and monthly data for three sets of customers:

1. Customers who changed their rate class to a suboptimal (non-MEP) rate class: 9,970 customers[66]

2. Customers who changed their rate class to their optimal (MEP) rate class: 39,760 customers[67]

3. Customers who did not change their rate class: 76,747 customers[68]

The customer groups that are ascribed damages are groups 1 and 3 above. We consider the appropriate time frame to assess potential damages is from February 2019 (the month the Initial Tool error was introduced) until February 2020, the month during which the New Tool was implemented.

The impact calculations do not include any kWh adjustments, since these shifts are negligible[69] compared to the bill shifts from the kW impact that occurred.

IMPACT FROM RATE CLASS SWITCHES DUE TO INCORRECT MEP RECOMMENDATIONS

In this section, we describe our quantification of customer bill impacts for customers who moved to a suboptimal rate plan, based on an erroneous recommendation. We also provide sensitivity analysis based

[66] APS Response to Staff Data Request No 11, Question No. 3(o).
[67] APS Response to Staff Data Request No 11, Question No. 3(o). This group of data was provided with data showing each customer's monthly bill and their MEP calculations based on their billing determinants, which verified that they were indeed on their MEP, hence alleviating the need to make further calculations for this group.
[68] Informal data requests after interviews
[69] The kWh would only be different by kWh hourly differences on the margin (either midnight hours when the weekday/weekend changes), or a maximum of 13 cents per kWh for R-TOU-E during on-peak vs. off-peak hours, which have a minuscule impact compared to $8.40/kW and $17.44/kW for hourly kWh shifts on the ordering of the totals under each rate class on an annual basis.

on rate impacts that stretch from November 2019 to February 2020. The main reason we believe ending all rate impacts in February 2020 are appropriate is because (a) all customers were informed with correct bills as to their new MEP, and (b) the new web tool became available for customers to obtain correct information from APS. The company's calculations are more inclusive in this regard, with rate impacts stretching to April 2020, to the extent that a customer has stayed on their incorrect MEP recommendation until that point.

The incorrect MEP recommendations began in February 2019, with the shift of the hourly customer data being delivered to GridX by one hour, hence 2pm to 7pm data became the peak hours by which the initial web tool started recommending the MEP incorrectly. This shift primarily affected the ranking of the R-2 and R-3 rate classes vis-a-vis the other rate classes, as they have a demand component based on the peak kW that happens during the 3pm to 8pm timeframe. This data shift was discovered by APS in November 2019, which resulted in the termination of using the Initial Tool. During this time, APS billing was not affected, as the data used for billing came from the registers within the customer meters, which became the billing determinants for each customer bill.

We analyzed the data set of bills of 9,970 customers that were indicated by the company as having switched to a non-MEP rate class due to the shift in the hourly data, and initially did an evaluation of our bill calculator to determine how close we were able to get to APS's billing system figures using APS's billing determinants based on the meter registers. The evaluation was preceded by the exclusion of partial bills with 14 days or less and bills for which the tax percentages were not certain. Our calculator yielded the following precision over the bills of the 9,970 customers, which Energytools judged to be satisfactory for the purposes of evaluating billing estimates with shifted peak kW figures[70]:

Exhibit IV-2

BILL CALC DIFFERENCES	Percentage
less than 1%:	99.68%
1%-2%:	0.11%
2%-3%:	0.01%
More than 3%:	0.20%
Total:	100.00%

[70] Most remaining differences were attributable to riders that we did not include in the calculations, and small bills that differed from rounding errors, as APS's billing methodology rounds each tax/adjustor component to the nearest cent, while our calculator does not. We compared calculations with the 3-8pm vs the 2-7pm peak kW done using our bill calculator, since these would both apply to either side of the calculation in the same fashion.

Using the billed amounts from our bill calculator using the correct peak kW, and then the incorrect peak kW, we determined (a) the difference of each bill from the MEP, and (b) the running 12 month total under each possible rate class, and looked for customers that had a change in their rate class on or after February 2019, and if they did, we calculated their monthly bill's difference from the MEP starting on that month, continuing for all months after that point. We excluded the following rate class changes from being attributed to the peak kW error:

- If the customer was on their MEP in their prior month, and both the correct and the incorrect peak calculation pointed for the customer to stay on that correct MEP rate class;
- If the customer was on their MEP in their prior month, and they changed their rate class to the correct MEP rate class that was indicated by the correct calculation for that month;
- If the customer would have been recommended the same MEP based on both the correct and incorrect peak kW calculation on the month before they switched their rate class (assuming that they changed their rate class on that month, and the change went into effect the next month)
- If the customer's rate class was likely made by the Company and not by the customer, namely switches between R-BASICL, R-BASIC, and R-XS, which happen automatically based on the customer's average kWh usage over time;
- If the customer stayed on an older 'E' rate class up until 2019, and their rate class change was their first one; and
- If the customer were on a R-XS or R-BASIC class, they no longer qualified for either rate class, or their new rate class was R-TOU-E, which would also be a company induced rate class move.

Based on the tally of the difference of each bill from the MEP, we generated the estimates for total ratepayer impacts. According to our calculations, the rate impacts occurred for **2,889 customers** – the rate impacts quoted below **do not** take into account any further rate class changes made by the customer, as any customer changing to their MEP would have no negative rate impact from that point forward.

Exhibit IV-3

		Rate Impacts from Feb-19 through:			
	Customers affected	**Nov-19**	**Dec-19**	**Jan-20**	**Feb-20**
Base Case Estimate:	2889	$99,510	$135,676	$185,045	$221,762
Lower Bound Estimate:[71]	785	$37,780	$47,258	$64,662	$76,990

[71] Excludes customer bill impacts that are less than $10 or less than 3% different from their MEP.

In comparison, the Company has calculated the following rate impacts for these customers, where it did not exclude customers based on several of the elimination rules that we have described above. Assuming rate impacts no longer accrued for a customer if the customer switched their rate plan after November 2019:

- **For rate impacts until November 2019 to 5,274 customers**: $223,194
- **As an inconvenience reimbursement to all 9,970 customers:** $25 * 9,970 = $249,250
- **For rate impacts after November 2019 until April 2020 to 5,258 customers:** $310,057

Finding IV-1. Energytools estimates that 2,889 customers were potentially affected by incorrect MEP recommendations by the Initial Tool from February 2019 through November 2019. The estimated bill impact for these customers over the period during which the Initial Tool was providing incorrect rate recommendations is $99,510. If one were to expand the time period over which bill impacts are assumed to accrue through February 2020, the first full month after the New Tool was available to customers, the Energytools estimate of bill impacts to customers is $221,762.

Finding IV-2. Using a more expansive definition of what constitutes a negative bill impact for customers, the Company has estimated that 5,274 customers were potentially affected by incorrect MEP recommendations by the Initial Tool from February 2019 through November 2019, with an estimated total bill impact of $223,194.

Finding IV-3. For the months beyond November 2019, the Company refunded $310,057 to customers. Energytools estimates that the additional bill impact is $221,762 - $99,510 = $122,252. A portion of this difference is due to the fact that the Company has quantified bill impacts over a longer time period than used by Energytools in its analysis (through April 2020).

Impact from rate classes that were not switched, potentially due to incorrect MEP recommendations recommending the customer to stay on their suboptimal rate class.

In this section, we describe our quantification of customer bill impacts for customers who stayed on a current suboptimal rate plan, based on an erroneous recommendation. Specifically, a customer may have stayed on their "incorrect" rate class thinking it is the MEP, which is indicated by the following conditions:

- The customer did not change their rate class over the period from February to November 2019;
- The customer's rate recommendation under the incorrect peak kW calculation was different than the rate recommendation under the correct peak kW calculation but was the same as their current rate class for any month over the period of February 2019 to November 2019.

APS determined that 3,001 customers may have been affected this way, based on a limited group of customers who were (a) in the APS.COM website log (although not necessarily having used the web tool), or (b) called into the customer call center to discuss his or her rate plan, and sent them refunds as follows:

- **For rate impacts until November 2019 to 2,766 customers:** $148,738
- **As an inconvenience reimbursement to all 3,001 customers:** $25 * 3,001 = $75,025
- **For rate impacts after November 2019 until April 2020 to 1,019 customers:** $58,907

To evaluate comparable rate impacts, we evaluated all customers who were in the GridX data set of customers[72] who did not change their rate class, 76,747 customers. Using hourly consumption data as well as monthly billing data for these customers, we determined that 64,613 customers were potentially affected[73], and calculated the following rate impact estimates:

Exhibit IV-4

		Rate Impacts from Feb-19 to:			
	Customers affected	Nov-19	Dec-19	Jan-20	Feb-20
Base Case Estimate:	4,098	$230,290	$274,290	$305,955	$339,229
Lower Bound Estimate:[74]	3,356	$172,822	$209,739	$233,737	$257,576

Finding IV-4. Using the subset of customers in their APS.COM and call center logs for customers who did not change their rate class, the Company has estimated that 3,001 customers were potentially affected by incorrect MEP recommendations by the Initial Tool from February 2019 through November 2019, and provided refunds of $148,738 accordingly, followed by $58,907 refunded for the period up through April 2020.

Finding IV-5. As an upper bound, Energytools estimates that 4,098 customers who stayed on an incorrectly recommended rate class were potentially affected by incorrect MEP recommendations by the Initial Tool. The estimated bill impact for these customers over the period from February 2019 through November 2019 during which the Initial Tool was providing incorrect rate recommendations is $230,290. If one were to expand the time period over which bill impacts are assumed to accrue through February 2020, the first full month after the New Tool was available to customers, the Energytools estimate of bill impacts to customers is $339,229. However, the bill estimate precision for this group of

[72] As provided through informal data requests after interviews with APS staff.

[73] Based on customer data available after merging hourly data with monthly billing data for 2019.

[74] Excludes customer bill impacts that are less than $10 or less than 3% different from their MEP.

customers is less than the corresponding precision for those customers who changed to a different rate class. Therefore, we believe that the lower bound estimate, based on excluding bill impacts that are less than $10 or less than 3% different from their MEP, is probably a better estimate.

3. CONCLUSION

This chapter calculates the ratepayer impacts from potentially inaccurate MEP recommendations made by the Initial Tool over the period February 2019 to November 2019 for two groups of customers: those customers who made a suboptimal rate class change based on an incorrect MEP recommendation by the Initial Tool and those customers who remained on a suboptimal rate class based on an incorrect MEP recommendation by the Initial Tool. Recognizing that there is imprecision in this estimate because it is not known precisely what recommendations were made by the Initial Tool or whether customers would have chosen the MEP given correct information, it would appear that the Company has adequately compensated customers who changed rate classes for any potential bill impacts associated with the Initial Tool error.

With respect to those customers who remained on a suboptimal rate class based on an incorrect MEP recommendation by the Initial Tool, we believe that there may be as many as 1,100 more customers than estimated by the Company who were provided incorrect information from the Initial Tool and, as a result, stayed on a suboptimal rate, although the Energytools estimate is an acknowledged "upper bound" on customers who may have been affected. Furthermore, our estimate of rate impacts, including these customers, could potentially be higher in total than the Company has estimated although this is again an upper bound.

energytools, llc.

11910 Parklawn Drive, Suite P, Rockville, MD 20852
Ph: 240.221.0880 • Fax: 240.465.3000

www.energytoolsllc.com